Better Homes and Gardens®

WOOD

SPECIAL HOLIDAY GIFTS EDITION

THE MAGAZINE FOR HOME WOODWORKERS

$3.50

December 1985 • ISSUE NO. 8
Display Until December 19

HOW TO BEND LAMINATED WOOD

It's easier than you think! Step-by-step, plus 2 great plans

WHAT'S NEW IN SCROLL SAWS

Complete buying guide, page 54

ROUTER BITS

How your choices shape up

PROJECT PLANS

Old-time sled
Bentwood coat-tree
Woodworker's mallets
Laminated desk set
Snack tray
Toy jeep
And much more . . .

GIFTS GALORE!

8 BRIGHT NEW IDEAS FOR HOLIDAY GIVING (See page 62)

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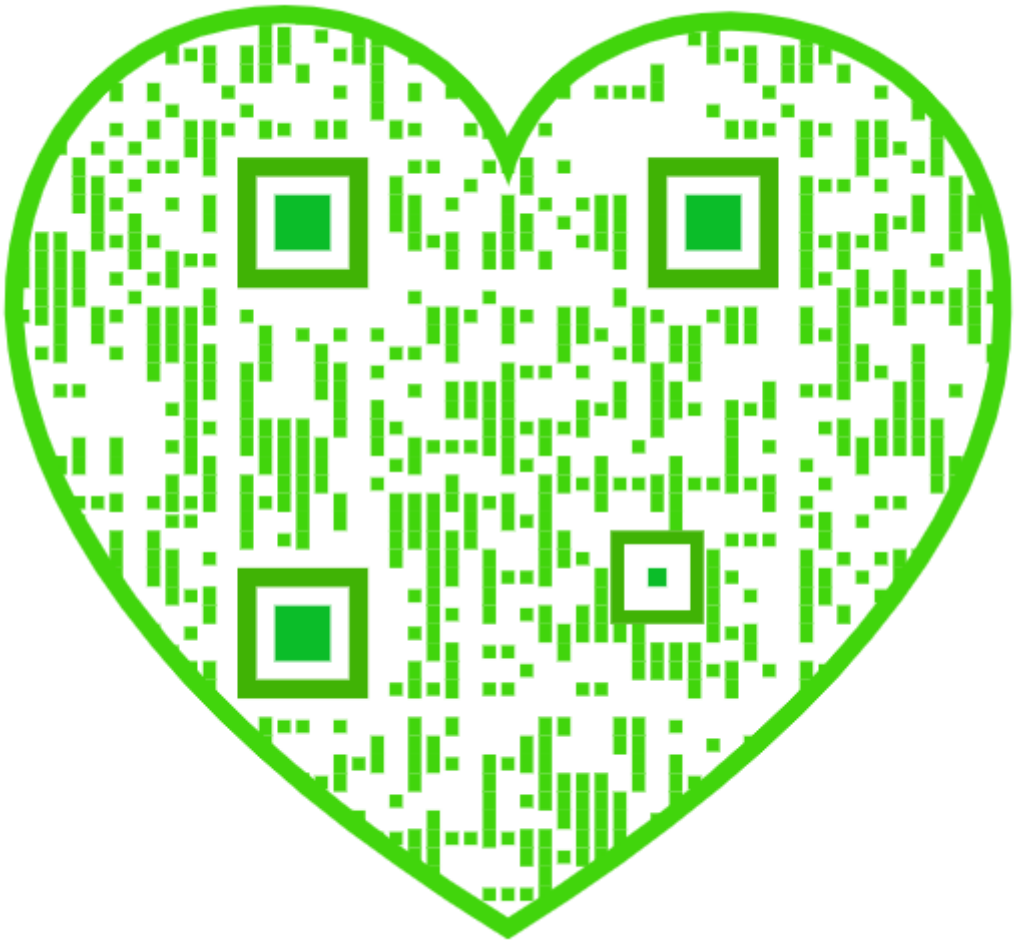

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Millions have discovered that hand-built is better than store-bought, in so many ways. And once you start enjoying the rewards of woodworking, we think you'll agree.

There's no comparison.

Any child would be happy with the sled on the left. But the store-bought version has its drawbacks.

First of all, it's not nearly as durable as our all-wooden flyer. Most mass-produced goods just aren't made to last like hand-built originals. And if one of the parts breaks or gets lost, chances are you're not going to be able to fix it very easily.

On the other hand, the sled on the right will last a lifetime because you build every inch of it with durable wood you select yourself. And if it does need a little repair over the years, you can do it because it's made with wood. And the price? You can build our custom-built sleigh right down to the wooden runners and cherry inlay — for less than half the cost of store-bought!

Combine these benefits with the satisfaction of creating something unique with your own two hands, and you get far more for your time and money when you do-it-yourself.

Build it right, build it for less, with Shopsmith.®

Making things for loved ones, instead of just buying them, is one of the many accomplishments you can enjoy when working with wood. You can also custom-build furniture, bookshelves or other furnishings to suit your lifestyle and fit your home. Or, with a little experience, you can build exact replicas of classic antiques you might never be able to afford otherwise. And Shopsmith can help you do it right with woodworking tools that are made for the job.

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Christmas Time

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NEWPORT

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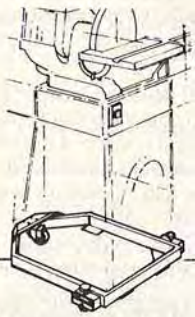

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WOOD

THE MAGAZINE FOR HOME WOODWORKERS

DECEMBER 1985 **ISSUE NO. 8**

WOOD PROFILE

PECAN: THE 'GREAT SPIRIT' HICKORY 29

This prolific member of the hickory family, once revered by the Indians, combines remarkable strength, elasticity, and beauty.

CRAFTSMAN CLOSE-UP

A RENAISSANCE FOR HANDCRAFTED PSALTERIES 30

The ethereal tones of the bowed psaltery have captivated listeners since the Renaissance. Now, a trio of Florida woodworkers has sparked renewed interest in this fascinating instrument—a delight to both the eye and ear.

HOMEMADE TOOL

HARD MAPLE WOODWORKER'S MALLETS 34

Skilled woodworkers count a wooden mallet among their most trusted tools. Our designs feature large, leather-protected striking surfaces.

SHOP-TESTED TECHNIQUES

HOW TO BEND LAMINATED WOOD 36

Ready to break out of the mold and do some extraordinary things with wood? Here's how to laminate thin strips into truly distinctive curved designs.

NOW YOU CAN BUILD IT

OAK COAT-TREE 42

You won't find a better test project for our bentwood lamination technique than this coat-tree, with its curved uprights of resawn oak strips. Save the forms and make several.

JUST LIKE GRANDDAD'S!

BENTWOOD SLED 44

Build this young-at-heart heirloom and you're sure to light up a youngster's heart. The laminated runners and supports make this sled amazingly strong, yet lightweight.

BUYMANSHIP BASICS

ROUTER BITS: HOW YOUR CHOICES SHAPE UP 50

Bit by bit, your router bit inventory builds until it's worth more than your router. Here's how to sort out all those types of bits and what they do.

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THE NEW CONSTANT-TENSION SCROLL SAWS 54

No time for a scroll saw in your shop? You may change your mind after you read about the latest models and features.

BUYMANSHIP BASICS

EPOXY: THE "TOUGH GUY" GLUE MOST WOODWORKERS NEVER USE 60

If you haven't tested epoxy in your shop, it's high time you give it a try. This amazing adhesive, long popular with boaters, offers exceptional strength and moisture-resistance.

PEOPLE-PLEASING HOLIDAY GIFTS

ZEBRAWOOD SNACK TRAY 62

Serve up this great gift and we guarantee you'll make a hit with somebody special.

JIM-DANDY JEEP 64

Any pint-sized mechanic will love assembling and disassembling this take-apart toy.

NEW HORIZON DESK SET 66

One lamination yields enough of the laminated wood design for two handsome desk sets.

THE 3 CHARM BEARS 70

We think you'll be totally "charmed" by these kids' room specials.

'JUST FOR HER' NECKLACE 71

This classy hardwood necklace will delight her and showcase your woodworking skill at the same time.

DESERT DAYBREAK WALL HANGING 72

A palette of thin-sawn woods captures a striking scene. It's a special gift someone in your life will treasure for years to come.

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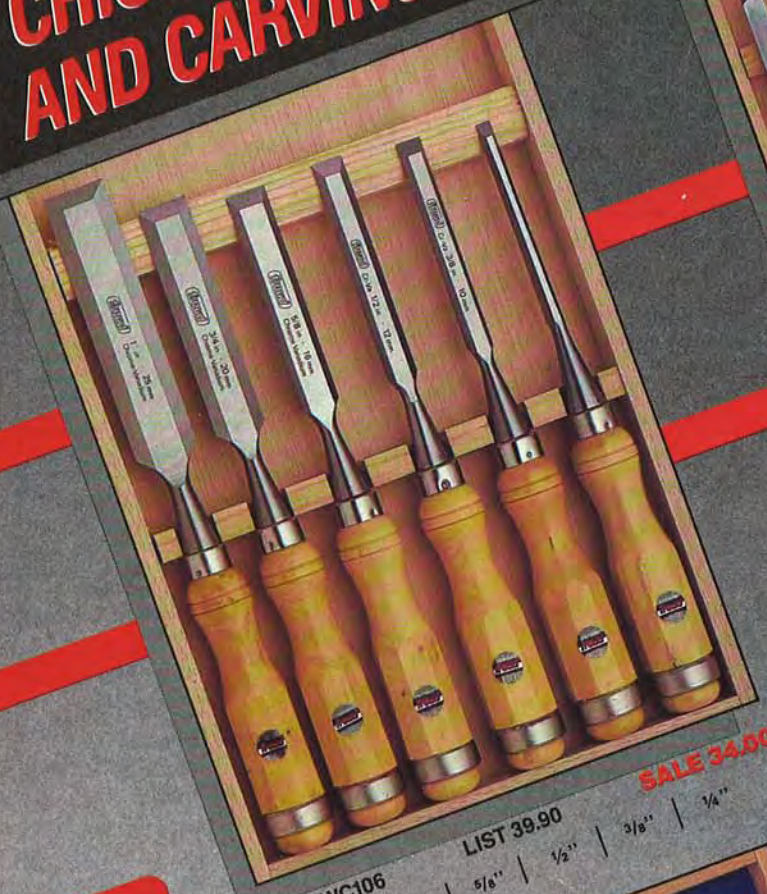

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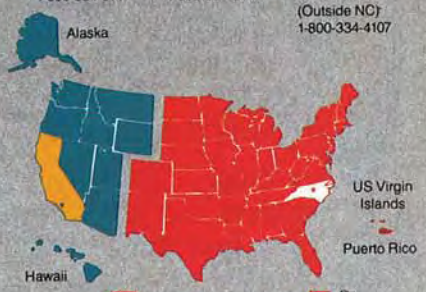

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THE EDITOR'S ANGLE

We do more than stand behind our product; we stand on it!

WOOD magazine sledding enthusiasts (from left): Jim Downing, me, and Marlen Kemmet—596 lbs. total.

A funny thing happened the other day on the way to the coffee pot. I spotted Design Editor Jim Downing (that's him wearing the scarf in the photo) jumping up and down on the sled shown above. One of the other staffers, I found out later, had asked Jim if the sled would hold together if someone actually used it, so Jim went into his Jumping-Jack routine to emphasize his point.

That short episode started me thinking about the many woodworkers I've met, and how almost every one of them has displayed the same enthusiasm about their hobby and pride in their product as Jim did. That's refreshing, especially today when it seems that so many people think that "pretty good is good enough."

Speaking of a quality product, I'm particularly proud of this holiday 1985 issue of *WOOD*. There's a fact-filled article on epoxy glue (the stuff we put the sled together with), lots of holiday gift ideas (we know you're busy, so we kept them quick to build), a six-page article on scroll saws, and another on bending laminated wood, plus all our regular features. Here's hoping you find some enjoyable reading along the way.

On behalf of the entire *WOOD* magazine staff, I'd like to wish you the happiest of holidays and a healthy, happy 1986.

Larry Clayton

Print this article

CARBIDE TIPPED ROUTER BITS
PROFESSIONAL PRODUCTION QUALITY
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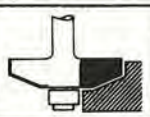
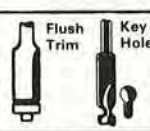
BEST CUT BEST PRICE	ITEM NO.	DESCRIPTION	RADIUS	LARGE DIAM.	CUTTING LENGTH	PRICE
		COVE				
	#01	1/4" R	1/4"	1"	1/2"	$13.00
	#02	3/8" R	3/8"	1¼"	9/16"	14.00
	#03	1/2" R	1/2"	1½"	5/8"	15.00
		ROUND OVER				
	#04	1/4" R	1/4"	1"	1/2"	15.00
	#05	3/8" R	3/8"	1¼"	5/8"	16.00
	#06	1/2" R	1/2"	1½"	3/4"	19.00
		ROMAN OGEE				
	#07	5/32" R	5/32"	1¼"	15/32"	18.00
	#08	1/4" R	1/4"	1½"	3/4"	20.00
	#11	3/8" RABBETING	Deep 3/8"	1¼"	1/2"	14.00
	#09	1/8" (KERF) SLOT CUTTER		1¼"	1/8"	14.00
	#10	1/4" (KERF) SLOT CUTTER		1¼"	1/4"	14.00
	#12	45° CHAMFER	45° Angle	1½"	5/8"	15.00
	#15	RAISED PANEL	20° Angle	1-5/8"	1/2"	25.00
		DOVETAIL BITS				
	#16	3/8" DOVETAIL 9°		3/8"	3/8"	7.50
	#17	1/2" DOVETAIL 14°		1/2"	1/2"	8.50
	#18	3/4" DOVETAIL 14°		3/4"	7/8"	10.50
		CORE BOX (ROUND NOSE)				
	#19	3/8" CORE BOX	3/16"	3/8"	3/8"	11.00
	#20	1/2" CORE BOX	1/4"	1/2"	11/32"	14.00
	#21	3/4" CORE BOX	3/8"	3/4"	5/8"	18.00
		GROOVE FORMING OGEE				
	#22	1/2" GROOVING OGEE		1/2"	3/8"	16.50
	#23	3/4" GROOVING OGEE		3/4"	7/16"	21.00
	#24	1/4" Straight Bit		1/4"	1"	7.00
	#25	5/16" Straight Bit		5/16"	1"	7.00
	#26	3/8" Straight Bit		3/8"	1"	7.00
	#27	1/2" Straight Bit		1/2"	1"	7.00
	#28	3/4" Straight Bit		3/4"	1"	10.50
 Flush Trim / Key Hole	#13	1/2" FLUSH TRIM		1/2"	1"	8.50
	#14	3/8" KEY HOLE (This Bit only HSS)	CUTS 3/8" KEY HOLE FOR FLUSH MOUNTING PICTURE FRAMES, ETC.			8.50

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TALKING BACK

We welcome comments, criticisms, suggestions... even an occasional compliment from readers. While the volume of mail we receive makes it impossible to answer every letter, we publish excerpts in every issue of the magazine. Send your letters to:

Letters Editor
Better Homes and Gardens®
***WOOD* Magazine**
1716 Locust Street
Des Moines, IA 50336

BEWARE OF TREE RUSTLERS!

Your short article on paulownia trees (*WOOD*, August, 1985, page 81) was very interesting. However, you should warn your readers that thefts of these beautiful trees have increased dramatically. As a police officer in central Maryland, I have seen many such incidents. My suggestion to honest people looking for this type of wood is to know your supplier. I don't think you'd want lumber that was taken from a neighbor's yard at 3 a.m.

—Allen Hafner, Catonsville, Md.

We've heard of a few walnut trees being pirated from farms in our part of the country, but we didn't realize that the problem extended to other species as well. A word to the wise. . . .

SPRAY-ON VELVET LINING

Several readers have contacted WOOD *wanting to know where they can obtain the spray-on drawer lining mentioned in the article about Richard Rothbard (August, 1985, page 26). You can purchase a "starter kit" containing brown and green fibers, adhesive, and a spray gun for $41.50 (postage due on delivery). Write to: Donjer Products, 55 Alder St., Unit D, Dept. W, West Babylon, NY 11704.*

CARD HOLDERS

On page 38 of the April, 1985 issue, the modular workbench group shows metal holders for tags to identify drawer contents above the drawer pulls. I'm unable to find them—please provide a source.

—Charles J. Hanrahan, Keene, N.H.

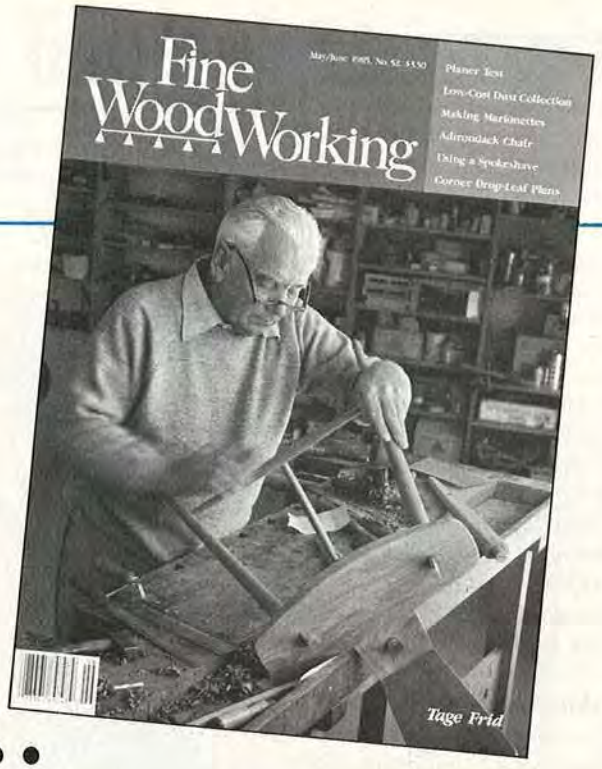
We bought our brass-finish card holders at a local hardware store. You can order them from The Woodworkers' Store, 21801 Industrial Blvd., Dept. W, Rogers, MN 55374. Price: $7.90, including postage and handling for a 10-pack (catalog #D3060, 1⅛×2¼").

PANEL-RAISING SYSTEMS: LAST CALL

Yet another panel-raising router bit system has surfaced (see "Talking Back" on pages 12 and 19 of the October, 1985 issue). We want you to know about this one in particular because it performed beautifully in our shop, and the cost compares very favorably with other systems. Made in Taiwan, it's available from Furnima Industrial Carbide. Cost is $103 U.S. (½" shank) or $95 U.S. (¼" shank). For further information, write Furnima at Bierknakie Road, Box 308, Dept. W, Barry's Bay, Ontario, Canada KOJ 1BO.

COMING SOON: *WOOD* Q&A

Got a question about a woodworking problem? Need advice about finishing, joinery, wood species, power tools, or any of the hundreds of other subjects that make woodworking such a challenging and fascinating hobby? We invite you to drop a note to WOOD *Reader Questions Column,* WOOD *Magazine, 1716 Locust St., Des Moines, IA 50336. We can't promise a personal reply to each letter, but we'll answer as many questions as we can.* ■



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Print this article

In woodworking, as in life, no one knows it all. But through experience, we all discover—or stumble onto—better, safer, faster, or easier ways to do things. When we devise interesting tips or techniques, we'll share them with you in this column. And when you send us your favorites, we'll pay you $25 for each submission we publish. No shop tips can be returned. Mail your tips to:

Shop Tips
Better Homes and Gardens®
***WOOD* Magazine**
Locust at 17th
Des Moines, IA 50336

Toothpick magic

Rarely can you find the right size small pieces of wood around your shop for the array of small gluing tasks.

TIP: Next time you're in the grocery store, pick up a box of flat toothpicks for your workshop—you'll be amazed at how helpful they can be.

A toothpick is handy for spreading glue and working glue into tight cracks. Toothpicks also make a world of difference when you glue them into loose screw holes. Fill a slightly off-centered screw hole with toothpicks and glue, allow to dry, and then drill a new screw hole on the edge of the original hole. These handy mini-timbers can also fill old nail holes in salvaged lumber; leave the ends long and sand smooth after the glue dries.

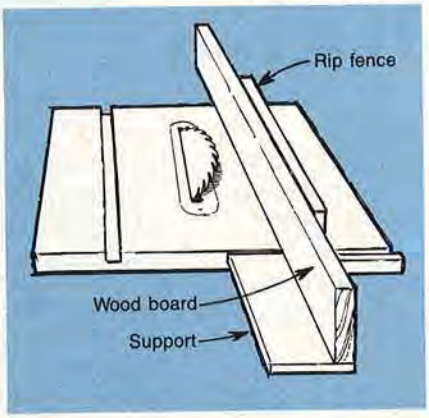
E. R. Huckleberry
Salt Lake City, Utah

A bevel on the level

The trick to cutting an accurate bevel on a long piece of stock is to keep the board flat against the surface of the table saw. If either end of the board raises off the table, the bevel will be uneven.

TIP: Attach a long, straight board to your fence. (Many fences have pre-drilled holes for this purpose.) Before gluing a piece of wood to the underside of the leading edge, be sure you can still use the fence-tightening knobs. This jig will help keep the stock aligned as it feeds into the saw. Use a roller support on the outfeed.

Tom Peters
Midland, Mich.

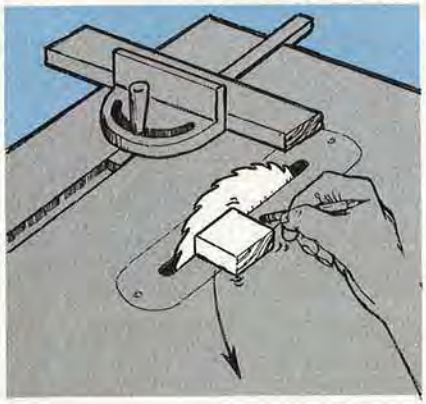


"Pencil pusher" safety tip

When mitering, scraps can linger too close to the blade, catch, and kick back.

TIP: The eraser end of a common pencil is a handy way to flick away potential missiles from a table saw blade. It's *much* safer than using your fingers to remove wood scraps.

—From the WOOD *shop*

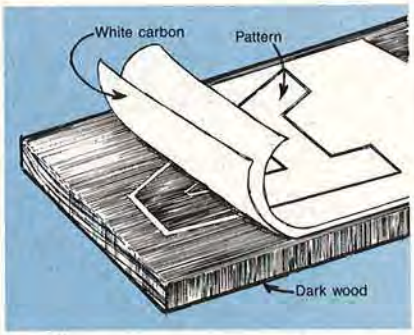


A tip from the sewing basket

Black or dark blue carbon paper becomes difficult to use when transferring paper patterns to dark wood. With the dark pattern outline, it's easy to make errors.

TIP: White carbon paper, found in many fabric and crafts shops, is ideal for transferring patterns to dark wood or ⅛" tempered hardboard. One manufacturer, S. B. Albertis Co., 322 W. 57th St., New York, NY 10019, markets their product under the name "Saral Transfer Paper."

Cobert LeMunyan
Troutman, N.C.



Sanding shortcut

Sanding those small, commercially available spindles can consume a lot of time and sandpaper.

TIP: Use a drill press to speed this process. Place one end of the spindle in the chuck (finger-tighten only). Then drive a no. 6 finishing nail through a piece of scrap and place the scrap (nailhead side down) on the drill-press table. Secure with a C-clamp. Each end of the spindle should have a small hole where attached to the lathe. Lower the spindle hole over the nail, turn on the drill press, and sand.

Richard J. Wessels,
St. Louis Park, Minn.

Continued on page 12

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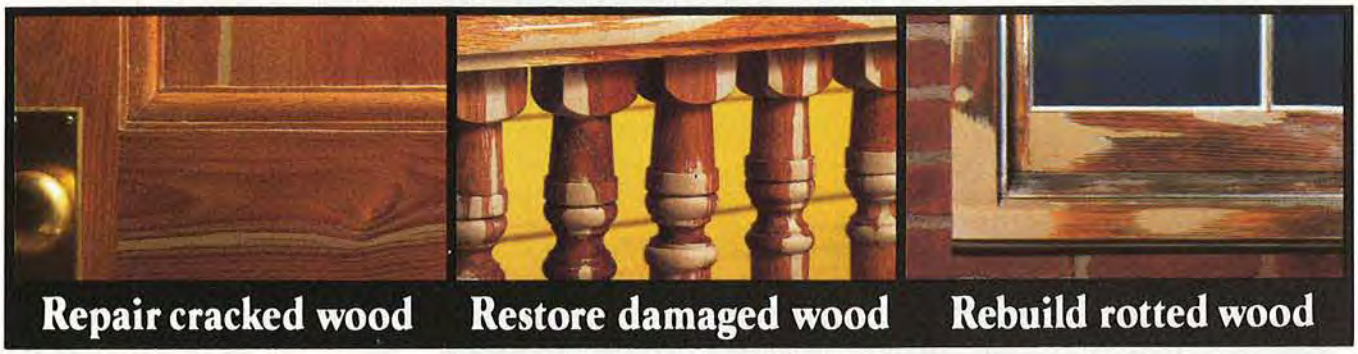

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TIPS FROM YOUR SHOP (AND OURS)

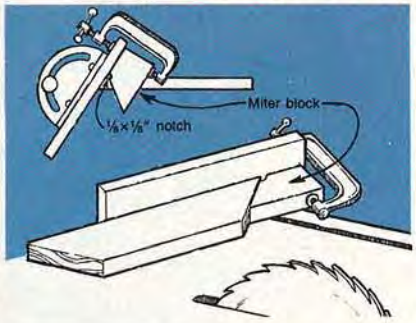
Continued from page 10

Improved miter stop

Sawdust build-up at a table saw miter stop can produce uneven lengths of pieces.

TIP: Cut a ⅛×⅛" notch in the block of wood used for a miter stop. In addition to solving the problem of sawdust build-up, the notch allows more freedom for the point of the mitered piece to fit snugly against the stop.

—*From the* WOOD *shop*



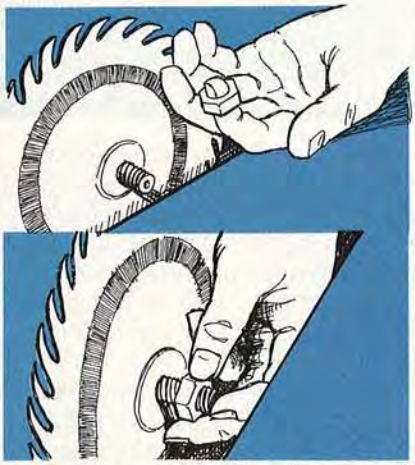
Oh, nuts!★!★

There it goes again

Once again you're digging through sawdust to find the arbor nut you dropped while changing the blades on your table saw.

TIP: Slip the nut onto your index finger. Then, while controlling the nut with your thumb and middle finger, place the tip of your index finger on the arbor shaft. Keep your index finger in contact with the arbor and spin the nut with your middle finger and thumb.

—*From the* WOOD *shop*



Continued on page 14

RYOBI TOOLS

		List	Sale
S500A	3x5½ Finish Sander	70	41
SU6200	Finishing Sand. ½ Sheet	142	88
B7075	3x21" dustless Belt Sand.	179	116
B7100	3x24" dustless Belt Sand.	208	140
B7200A	4x24" dustless Belt Sand.	269	165
D100VR	3/8"VSR 0-1200 rpm drill	91	49
W640	7¼" 13 amp circular saw	158	99
W740	8¼" 13 amp circular saw	171	109
JS60	Jig Saw-Single Speed	172	99
JSE60	Jig Saw-electronic v/speed	198	123
R150	1 H.P. Plunge Router	138	86
R330	2 H.P. Router	220	138
R500	3 H.P. Router	265	163
E3800	Drywall screwdriver 0-4000	126	79
L120U	3 5/8" Planer	142	89
BD1020R	3/8" 2-spd Cordless Drill w/free holster-Xtra special buy	148	95
TS251U	10" Mitre Box	300	169
SG1150C	4½" H.D. Mini-Grinder	99	59

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0234-1	1/2 drill 4.5A magnum	159	115
0244-1	1/2 drill 4.5A magnum	159	115
0222-1	3/8 drill 3.3A 0-100 rpm	146	99
0228-1	3/8 drill 3.3A 0-1000 rpm	129	95
0375-1	3/8 close quarter drill – NEW – 3.5 amp	175	118
0210-1	3/8 cordless drill – NEW – 2 speed	154	114
6539-1	cordless screwdriver – NEW – 190 RPM	84	64
1007-1	½" drill 4.5A D-Hdle	199	145
1107-1	½" drill 4.5A D-Hdle	204	145
3300-1	magnum rt angle drive kit	249	170
3102-1	Pimbrs rt angle drill kit	263	180
1676-1	HD Hole Hawg w/case 2 sp	333	235
5395	3/8 sgle sp hammer drill kt	203	150
5397	3/8 var sp hammer drill kit	208	155
5371-1	HD mag. hammer drill ½"	287	207
5373	HD mag. ham. drill 3/8"	240	175
6511	2 speed Sawzall w/case	181	123
6226	port band saw 2 sp w/case	382	280
6234	TSC band saw port w/case	382	280
6365	7¼" circ. saw 13 amp	169	109
6405	8¼" circ. saw 13 amp	179	127
6460	10¼ " " 15 amp w/case	349	245
6377	7¼ HD worm saw 13 amp	235	155
6378	8¼ HD worm saw 13 amp	249	165
6165	12" Chop Saw 15 amp 4200 R.P.M.	267	189
6170	14" Chop Saw 15 amp 3600 R.P.M.	289	209
6255	v/sp Jig Saw 3.8 amp	199	140
6245	sgle sp Jig Saw 3.8 amp	175	125
6012	½ sheet HD Orb. sander	159	110
6014	½ sheet HD Orb. sander	169	115
5935	4" by 24" belt sander w/bag 10 amp	319	215
5660	1½ HP router 10 amp	256	175
5680	2 HP router 12 amp	314	220
8950	Wet/Dry 8 gal vac 6 amp	145	110
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PS303	fine cutting	7¼"	40	32.97	20.50

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CARBIDE TIPPED SAWBLADES

Item No.	Description	Diam.	Teeth	List	Sale
LU72M010	Gen'l Purp.	10"	40	68.56	34
LU81M010	Gen'l Purp.	10"	40	69.30	35
LU73M010	Cut-Off	10"	60	79.65	36
LU82M010	Cut-Off	10"	80	86.40	44
LU84M010	Combination	10"	40	70.99	36
LU84M011	Combination	10"	50	74.51	37
LU85M010	Super Cut-Off	10"	80	110.88	62
LM72M010	Ripping	10"	24	64.85	34
DS 306	6" Dado			139.00	92
DS 308	8" Dado			170.00	105
TR 100	3 blades & Dado set			399.00	255

FORSTNER BITS (ARCO)
West Germany

Model	Size	List	Sale
2121	1/4	6.40	4.00
2122	3/8	7.00	4.50
2123	1/2	7.80	5.00
2124	5/8	10.35	6.50
2125	3/4	10.95	7.00
2126	7/8	11.40	7.25
2127	1	12.25	7.75
2128	1-1/8	12.75	8.00
2129	1-1/4	13.85	8.75
2130	1-3/8	16.45	10.50
2131	1-1/2	18.15	11.00
2132	1-5/8	21.25	14.50
2133	1-3/4	23.95	16.50
2134	1-7/8	25.50	17.50
2135	2	26.25	18.25
2136	2-1/8	30.50	20.50

16 Pieces *(one of every size of above)*
List Price 254.80 ★ SALE PRICE 150.00
4 Pieces *(1/2 - 5/8 - 3/4 - 1")*
List Price 38.95 ★ SALE PRICE 25.00

MAKITA TOOLS

		List	Sale
B04510	Sander	79	43
9900B	3"x 21" belt sander	198	119
9924B	3"x 24" belt sander	188	135
9924DB	3"x 24" b/sand. w/bag	214	130
9035	⅓ sheet finish sander	79	48
9045B	½ sheet finish sander	156	90
9045N	½ " " " w/bag	158	105
4200N	4-3/8 circ. saw 7.5 amp	152	95
5008NB	8¼ circ. saw 13 amp	178	105
5201NA	10¼ circ. saw 12 amp	348	215
4300BV	v/sp jig saw 3.5 amp	192	120
4301BV	orb v/sp jig saw 3.5 amp	206	125
2401BW	10" mitre saw	329	185
2400BW	10" mitre saw (for v/ce)	369	249
JR3000WL	2 sp recip saw w/case	168	120
JR3000V	vs recip saw w/case	178	120
6010DWK	3/8 cordless drill w/case	152	89
5081DW	3-3/8 cordless saw kit	165	109
1900BW	3¼" planer w/case	154	92
1100HD	3¼" planer w/case	278	160
3608BK	¾ hp router w/case	132	85
3601B	1-3/8 hp router	168	115
3700B	½ hp trimmer 28,000 rpm	124	82
B04530	6" Round Sander	84	55
6710DW	Cordless Screwdriver	148	105
DA3000	3/8" angle drill	158	105
DP4700	½ v/sp w/rev " 4.8 amp	154	92
HP1030W	3/8 v.s.r. hammer drill w/case	145	98
6300LR	⅓" angle drill w/rev	229	152
841988-2W	½" 2 sp. hammer drill w/case	238	150
GV5000	Disc Sander	79	53
6800DB	2500 rpm 3.5 amp	123	79
6800DBV	0-2500 rpm 3.5 amp	133	89
6801DB	4000 rpm 3.5 amp	123	79
6801DBV	0-4000 rpm 3.5	133	89
2030n	12" planer/jointer	1980	1350
2040	15-5/8" planer	1780	1195
1805B	6-1/8" planer kit w/case	416	285
LS1400	14" Mitre Box	578	410

★ ***NEW* from MAKITA!** ★

Model		List	Sale
9820-2	Blade Sharpener	235	160
6802DWK	3/8" 2-sp c/less drill kit	154	94
6010SDW	3/8" cordless drill rev	82	45
DA3000DW	3/8" c/less angle drill	172	105
JV1800	var. speed jig saw	145	89
JV2000	var. speed orb. jig saw	165	100
4300DW	cordless jig saw	158	102
5005BA	5½" circular saw 8 amp. with brake	154	98
5600DW	6¼ c/less circ/saw	224	139
9207SPC	7" var/speed elecronic sander/polisher	209	130
9303BH	4½" sander-grinder kit	146	95
9035DW	c/less finishing sander	128	79
4014NV	var/speed blower	128	79

DELTA

		List	Sale
34-821	9" contr. saw w/o motor	500	395
34-410	10" contr. saw w/o motor	871	650
34-710	super 10" motorized saw	579	450
15-091	15" floor model D/press	467	375
15-090	15" bench model "	467	375
37-207	Saw/Jointer Combination	1018	810
37-609	6" Motorized Jointer	413	335
37-280	4" deluxe Joiner w/o motor	348	275
22-651	RC-33 — 13" Planer	1843	1450
43-122	Wood Shaper w/stand and 1 HP Motor	869	495
46-140	11" lathe, gap bed model w/stand w/o motor	407	335
52-493	1 hp motor for #34-621	170	130
62-042	1½ hp motor for #34-410	230	170
62-144	½ hp motor for #37-290	136	105
62-142	½ hp motor for #28-243 and #46-140	121	85

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SAW-A-THON by PORTER CABLE

#314 4½" trim saw
List 180 ..... SALE 109

#348-1 6½" top hdle
List 161 ..... SALE 100

#617 7¼" Push Hdle
List 168 ..... SALE 103

#587 7¼" Speedtronic
List 199 ..... SALE 125

#315-1 7¼" Top Hdle
List 166 ..... SALE 103

#388-1 8¼ Top Hdle
List 176 ..... SALE 110

DELTA
SUPER SPECIALS!

#33-150 SAWBUCK
List 656 ..... SALE 499

#28-560 BANDSAW
3 wheel
List 449 ..... SALE 349

#28-283 14" Band Saw with enclosed Stand and 3/4 hp Motor
List $897.00
Sale $675.00

#28-243 14" Band Saw with Open Stand without Motor
List $594.00
Sale $440.00

#22-651 13" Planer
List $1943.00
Sale $1295.00

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AMERICA'S LOWEST PRICED TOOLS
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SUPER CORDLESS SPECIALS from BLACK & DECKER

Model	DRILL KITS	List	Sale
1930	3/8" rev/ hi speed	165	110
1950	3/8" High Torque	165	110
5930	Reversible Hammer	179	120
1970	3/8 rev/hi torque screwdriver	179	120
1980	Rev/ adj. clutch Scrudrill	179	120

BRAND NEW! SUPER SPECIALS from MILWAUKEE

		List	Sale
0214-1	3/8" c/less driver/drill	154	109
8975	H.D. Heat Gun, 11.6A Low 570°F - High 1000°F	69	49
5920	belt sander 3x24 w/o bag	289	199
5925	belt sander 3x24 w/bag	309	215
5930	belt sander 4x24 w/o bag	299	209
5935	belt sander 4x24 w/bag	319	225

BRAND NEW! BLACK & DECKER

#9425 8¼" Compound Mitre Saw
Special Sale Price — $115.00

PORTER-CABLE *(buy of the year)*

Model 621 REVERSING DRILL
3/8" H.D. var/speed-4 amp 0-1000 rpm
List 120 ..... SALE 72
6 or more $69.00 each

★★ *ROUTER RIOT* by PORTER-CABLE ★★

Model		List	Sale
100	7/7 H.P. 6.5 amp	134	86
630	1 H.P. 6.8 amp	145	95
690	1½ H.P. 8 amp	189	125
691	1½ H.P. D-Hdle 8 amp	213	135
536	1½ H.P. Speedmatic Double Handle	295	185
537	1½ H.P. Speedmatic Double Handle	310	210
520	3 H.P. Production	435	275
518	3 H.P. Micropressor 5-sp	475	310
	TRIMMERS by PORTER-CABLE		
309	3.8 amp laminate trimer	120	78
310	3.8 amp laminate trimmer	180	120
312	offset base laminate trim	195	130
319	tilt-base laminate trim	205	135

★ *X-TRA SPECIALS* ★

MAKITA TOOLS

		List	Sale
6010DL	C/less Drill w/flashlight charger & case	162	90
DP3720	3/8 drill Rev. 0-1800 rpm	90	47
6510LVR	3/8 drill Rev. 0-1050 rpm	116	67
6013BR	1/2" Drill Rev. 6 amp.	174	100
5402A	16" Circular Saw-12 amp	468	315
2414	14" Cut Off Saw-13 amp	282	169
3612BR	3 HP Plunge Router	286	175
9401	4x24 belt Sander w/bag	248	160

PORTER-CABLE

		List	Sale
696	H.D. Shaper Table	150	105
695	H.D. 1½ hp Router/Shaper	278	190
399	Drywall Cut-Out Unit	100	70
736	V/Speed *Speedtronic* Band Saw	450	330
7564	½ " X.H.D. Drill 8 amp	205	145

BOSCH TOOLS

		List	Sale
1581VS	Top Handle Jig Saw	225	126
1582VS	Barrel Grip Jig Saw	125	118
1604	1¾ H.P. Router	199	110
1942	Heat Gun 650° — 900°	99	65
1272	3x24" Belt Sander	259	159
1272D	3x24" Belt Sander w/bag	274	169
1273	4x24" Belt Sander	274	169
1273D	4x24" belt sander w/bag	289	179

DELTA

		List	Sale
34-010	Motorized Mitre Box	231	149

★ NEW LOW PRICES ★
PONY CLAMP FIXTURES

Model		List	Sale	Lots of 12
#50	for ¾" Black Pipe	11.23	7.40	80.00
#52	for ½" Black Pipe	9.36	6.10	67.50

JORGENSEN HAND SCREWS

Model	Jaw Length	Open Cap.	List	Sale	Box of 6
#5/0	4"	2"	11.59	7.25	39.15
#4/0	5"	2½"	12.45	8.10	43.75
#3/0	6"	3"	13.35	8.50	45.95
#2/0	7"	3½"	14.35	8.85	48.35
#0	8"	4½"	15.87	9.95	53.75
#1	10"	6"	18.25	11.35	61.25
#2	12"	8½"	20.94	13.50	72.95
#3	14"	10"	26.56	16.75	91.35
#4	16"	12"	34.56	23.75	128.25

JORGENSEN BAR CLAMPS
STYLE 37 — 2½" Throat 1/4" x 3/4"

Model	Jaw Length	List	Sale	Lots of 6
#3706	6"	7.88	5.50	29.70
#3712	12"	8.73	5.95	32.13
#3718	18"	8.84	6.95	37.53
#3724	24"	10.54	7.35	39.69
#3730	30"	11.76	8.25	44.55
#3736	36"	12.85	8.95	48.33

Who Has The Saws That Cut It Across The Board?

BLACK & DECKER of course!!!

Model	WORM DRIVE SAWS	List	Sale
3050	6½" 12 amp - 4600 rpm	247	169
3051	7¼" 13 amp - 4300 rpm	232	149
3052	8¼" 13 amp - 4300 rpm	247	169
	SUPER SAWCATS		
3047-09	7¼" w/brake - 12.5 amp	226	149
3048-09	8¼" w/brake - 13 amp	240	155
	BUILDERS SAW CAT		
3030	7¼" 13 amp - 5800 rpm	155	100
3035	8¼" 13 amp - 5800 rpm	175	125
3034	7¼" 13 amp - 5800 rpm	162	115
3033	6½" 13 amp - 5800 rpm	162	115
	JIG SAWS		
3157-10	var/sp orb action d/hdle	174	115
3153-10	var/speed 4.5A 0-3100	158	105
3159-10	2/sp orb action barrel grip	178	120
	CUT SAW KITS		
3103	2 sp 6 amp-2400 strokes	163	100
3105	V/Sp 6 amp-2300 strokes	170	110
3107	V/Sp orb 6A 0-2300 strokes	183	119
4300	Drill Bit Sharpener	299	205
1321	½" drill 450 rpm 6 amp	175	115
4010	Palm Sander	80	48
4015	⅓ Sheet Finish Sander	160	105
	DRYWALL GUNS		
2034	v.s.r. 0-4000 rpm	121	79
2037	v.s.r. 0-4000 rpm	139	89

"Door Openers" from MAKITA

		List	Sale
9501B	4" Grinder Kit	119	55
6012HDW	Cordless Drill w/Battery & Case	178	98
5007NB	7¼" Circ. Saw	158	94

MAKITA
Model 2708 — 8" Table Saw

	List	Sale
8" Table Saw	$336.00	$199.95
Holder Set	28.00	23.95
Carbide Blade	19.00	16.95
Table Saw Stand	48.00	39.95
Buy Each Piece Separately		**$280.80**
or Buy Total Package for		**$275.00**

Brand New • PORTER CABLE

Model 9629 — Electronic Var. Speed
Recipro Saw Kit w/steel case — 8 amp
List Price 189.00 ★ SALE PRICE 129.95

PORTER-CABLE

		List	Sale
9548	HD v/s bayonet saw w/case	255	179
648	HD s/s bayonet saw 3 amp	255	169
9627	2 sp. tiger saw kit 8 amp	183	118
505	H.D. ⅓ sheet finish/sander	165	103
330	spd bloc sander ¼ sheet sz	87	54
304	Professional 7" disc sander	160	105
305	Professional 7" polisher	160	105
7511	3/8"xtra hvy v/s drill 5.2 amp	154	100
7554	½" xtra heavy drill 8 amp	205	135
309	3.8 amp laminate trimmer	120	80
310	3.8 amp laminate trimmer	180	130
312	offset base laminate trim.	195	135
319	tilt base laminate trimmer	205	140
167	block plane 2.5 amp	129	86
9652	Versa-Plane Kit	419	285
9118	Porta Plane Kit	289	195
97650	½" dual range var/speed hammer/drill kit w/case	201	130
	DRYWALL SHOOTERS		
7544	5.2 amp — 2500 r.p.m.	154	100
7545	5.2 amp — 0-2500 r.p.m.	154	100
7546	5.2 amp — 4000 r.p.m.	149	100

AEG Power Tools

ROTARY HAMMERS

		List	Sale
PHE 16RL	3.8 amp 5/8" capacity In concrete	269	175
PH 210	5.2 amp-3/4" capacity In concrete	398	260
PHE 20	Same as above — except var/sp 0-750	418	270
PHD 26	6.3 amp-1" capacity In concrete	495	320
PH 38	7.5 amp-1½" capacity In concrete	549	355

All above complete with cases

✓ **Check our low prices on Percussion Carbide SDS Bits**

SKIL TOOLS

		List	Sale
551	5½" Circ. Saw 6.5A	99	75
77	7¼" Worm Saw	240	139
367	6½" Worm Saw	239	149
825	8¼" Worm Saw	270	185
807	7¼" Skilsaw 13A-Super	153	100
808	8¼" Skilsaw 13A-Super	172	110
2016-02	3/8" Cordless Drill complete W/Charger Case & 2 batteries	199	99

buying from *Seven Corners Hdw.* ... Is a good *Rule* to follow

STANLEY

Model		List	Sale
33-116 PL-316	¾" x 16' Rule	15.95	7.50
33-320 PL-320	¾" x 20' Rule	16.95	7.95
33-425 PL-425	1" x 25' Rule	18.95	8.95
33-430 PL 430	1" x 30' Rule	20.95	9.95

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TIPS FROM YOUR SHOP (AND OURS)

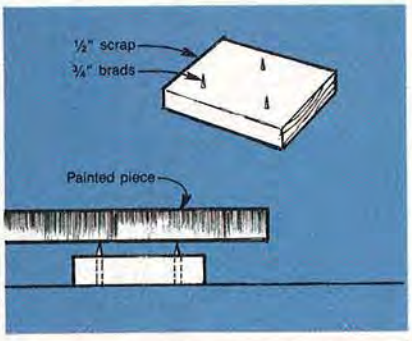
Continued from page 12

Cut painting time in half

All sorts of problems arise when you need to paint or finish the second side of a project. You can either wait for one surface to dry before turning the piece over, or you can finish both surfaces the same day and expect a lot of touchup on the side painted first.

TIP: Drive ¾" brads through scraps of ½" wood. Arrange three or more of these spacers on your work surface, turn the piece over, and continue painting on a horizontal surface. Save and reuse blocks of wood later.

James C. Hunt
Southgate, Mich.

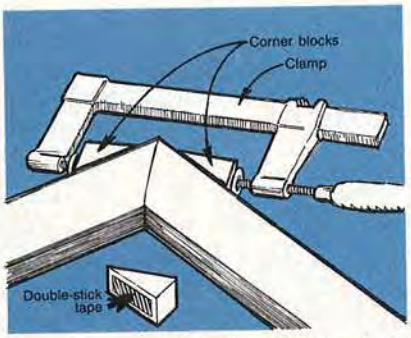


New angle on gluing corners

Triangular blocks often slip when you clamp 45° mitered corners.

TIP: Double-face carpet tape to the rescue again! A layer of tape on one surface of triangular block makes a world of difference when clamping mitered corners. After the glue has dried, save the blocks and reuse them on your next project. (Stay away from thin double-face tapes that don't have a lot of sticking power.)

Marvin C. Betcher
Davenport, Ia.



Continued on page 16

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JAY HEDDEN — Editor WORKBENCH Magazine

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ADDRESS _____

CITY _____ STATE _____ ZIP _____

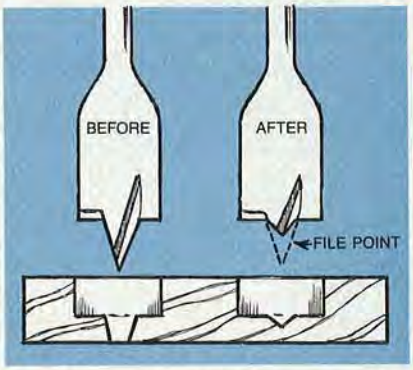
Continued from page 14

File away a boring problem

Without using an expensive Forstner bit, it's next to impossible to bore holes without breaking through the opposite side (i.e., when drilling a ½"-deep hole in ¾" stock).

TIP: By filing down the point of a spade bit, you can achieve the depth of cut you want without breaking through the other side. Even if you buy an extra spade bit just for this use, it still is cheaper than a Forstner bit.

Charles Hughes
Hamburg, N.Y.

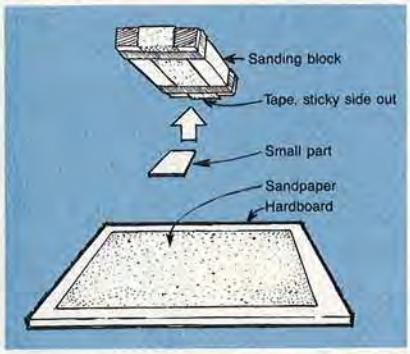


A real finger-saver

Fingertips and fingernails often get sanded as much as the wood when smoothing small parts.

TIP: Wrap masking tape (sticky side out) around a block of wood, and secure it with two pieces of masking tape wrapped the opposite direction. Stick the stock to be sanded to the masking tape and move the block across a sheet of sandpaper. You'll have the best results when the sandpaper is glued to a smooth surface.

Alex W. Flinsch
Garfield, N.J.

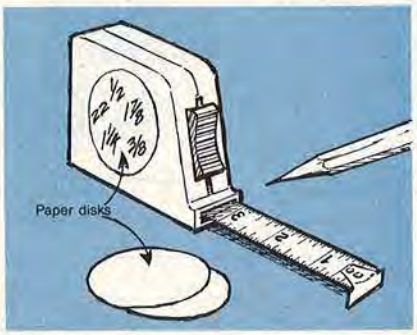


Noteworthy idea for shop scribblers

All too often, there's not a scrap of paper within reach to jot down figures after taking measurements.

TIP: You'll always have paper as near as your tape measure if you rubber-cement a piece to your tape-measure case. You can write and erase many sets of figures before replacing the paper. Those yellow self-adhesive notes also work well.

Steve Tegtmeier
Pittsburgh, Pa.

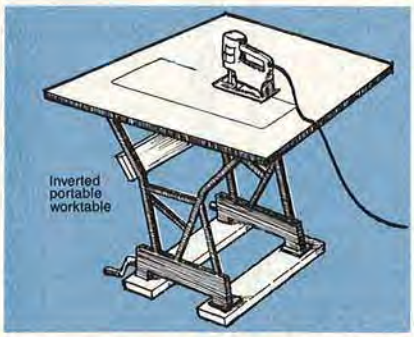


Bottoms up!

Supporting larger, floppy workpieces while doing inside cutting with a jigsaw can be a challenge. These projects often require a lot of stopping and turning to avoid sawing into the work surface.

TIP: Here's yet another use for those versatile, portable worktables. Turn the table upside-down and support the wood with the four legs while using your saber saw. You'll fast find this more convenient than sawhorses. ■

Dustin Davis
Frostburg, Md.



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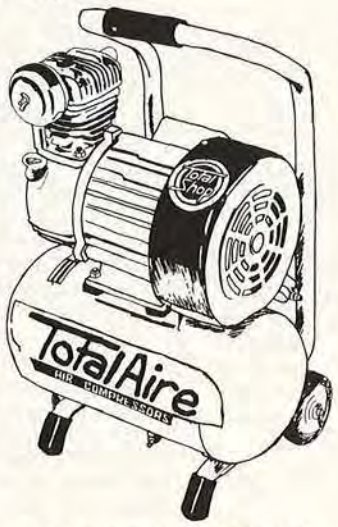

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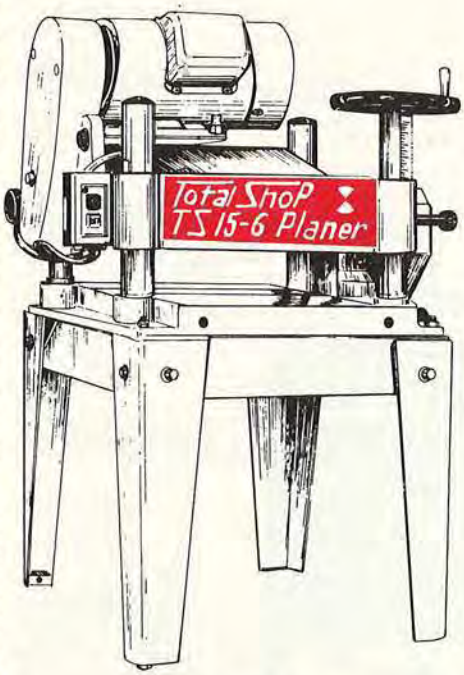

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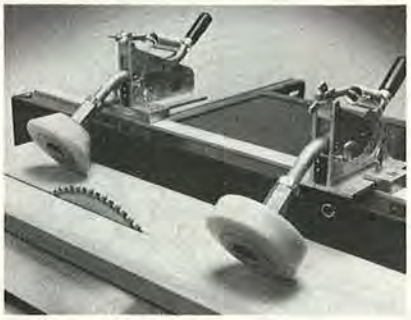

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Shophelper Safety Guides keep your hands away from finger-gobbling blades and cutters. The infeed wheel holds material down to stabilize the cut and guard against chatter. The outfeed wheel controls ripping until the stock is clear of the cutter area. Locking clutches prevent kickback. *Shophelper. Available through retailers and catalogs. We ordered ours for $83 postpaid from Western Commercial Products, P.O. Box 1202, 1515 E. Sunset Ave., Dept. W, Tulare, CA 93275.*

Cut your own wheels
If you're into toymaking, you know that wooden wheels, especially larger ones, can be expensive. Why not make your own with the Wheel Right? It's simple to use: Just drill halfway through a board, flip the board over, line up the pilot hole, and complete the drilling. Standard knives included in the kit cut 1½" to 4½" outside-diameter wheels. You also can special-order custom-made knives. *Wheel Right, $61.95 postpaid from The Tool Company, P.O. Box 629, Dept. W, Harrisonville, MO 64701.*

Try this Japanese waterstone
The Japan Woodworker, a California retailer, keeps a close eye on all Japanese woodworking tools, including the many waterstones now available. At their suggestion, we tested the 7½×2½×½" King S-3 Shiage Toishi, a 6,000-grit finish stone for final polishing. The results were excellent. *King S-3 Shiage Toishi Waterstone. Available through retailers and catalogs. We ordered ours for $11.95 postpaid from the Japan Woodworker, 1731 Clement, Dept. W, Alameda, CA 94501 (catalog #01.098.03).*

Continued on page 20

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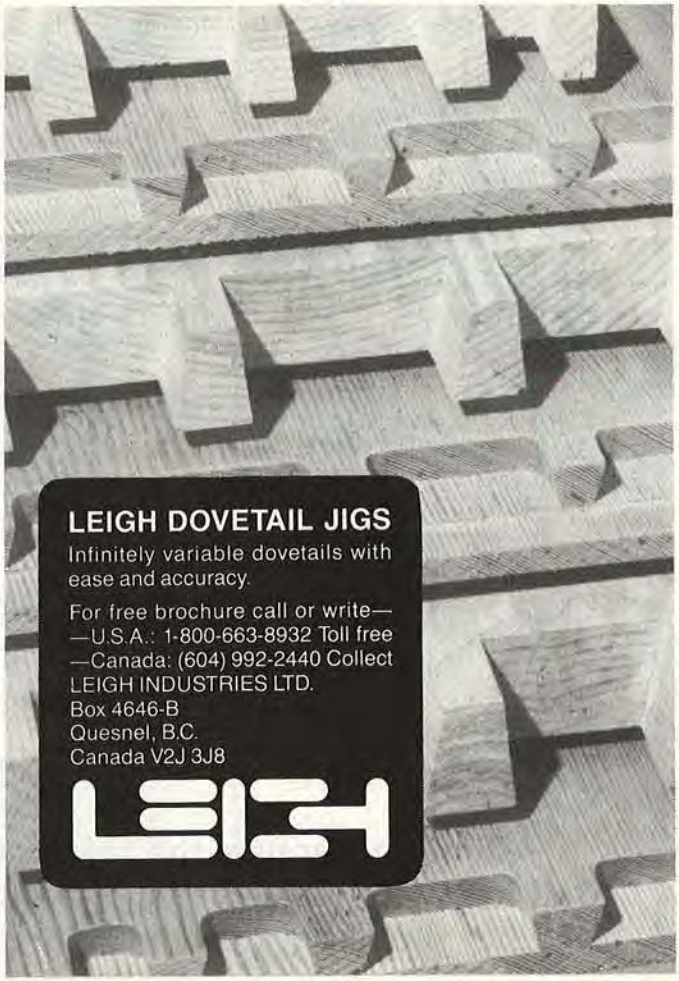

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Even if you've never built a model before, you can experience the relaxing pleasure and pride of accomplishment that is offered by this fascinating hobby. You can build the *Swift*. The secret's in our kit, designed especially for the first time modeler, with pre-cut parts that make assembly easy. Clear, large scale plans and instructions that virtually take you by the hand and guide you every step of the way through hours of the most relaxing fun you'll ever have. And when completed—a museum quality model you'll display with pride, with gleaming brass fittings, walnut planked hull, delicate rigging—lifelike in every detail.

Easy-to-build hull.

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Quality you can see and feel

The materials in our kit may be better than those used in the original *Swift*. The keel section and frames are pre-cut plywood, ready for quick assembly. The *Swift*'s hull is planked twice; once with thick, flexible limewood for strength, then overlaid with planks of African walnut for lasting beauty.

You won't have to make the fittings—we've done that for you. Our kit contains ready-to-use blocks and deadeyes of rare, yellow boxwood. We include eyelets, bracers and belaying pins—over 70 parts of solid brass! Even the cabin door hinges are brass, as are the 250 miniature nails you'll use to fasten the planking to the hull and deck. And, since the original wooden *Swift* had no plastic parts, our kit doesn't either—*anywhere!*

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PRODUCTS THAT PERFORM

Continued from page 18

Dent-free clamping

Does this sound familiar? You eagerly remove the clamps from a just-glued project, only to discover a scratch, dent, or stain left by a metal clamp. Cabinetmaker Greg Willis had the same problem, and he solved it by developing a line of long-lasting urethane clips. The configuration shown here slips onto ¾" pipe clamps. Other styles and sizes accommodate other types and sizes of clamps. *Clamp Clips, $5.95/pr. Available through woodworking catalogs or Heritage Tool Co., Box 226, Dept. W, Hampstead, MD 21074. $2.50 charge for postage and handling on all orders. Write Heritage first for an order form so that you can select the exact size and style you need.*

Straight talk about scraping curves

When violin and guitar makers need to scrape the contours of their creations, they use extra-thin scrapers to reduce stock. Because these German-made scrapers (sold in pairs) are just .4 mm thick, they conform to many surfaces in restricted areas. Even some wood sculptors find these scrapers handy enough to add to their tool chests. *Extra-thin Scrapers (catalog #08E44-DL). Available for $3.90/pr. postpaid from Woodcraft, 41 Atlantic Ave., P.O. Box 4000, Dept. W, Woburn, MA 01888.*

Putting some light on the subject

It's hard to imagine having fun with a lamp, but here you have it: There's something "magnetic" about this model (pun intended). The magnet allows you to place this lamp where you need it, quickly and easily. A 60-watt bulb in the reflector throws plenty of light, too. *Magnetic Lamp, model #1439. Available for $21.95 from Grizzly Imports, Inc., P.O. Box 2069, Dept. W, Bellingham, WA 98227.*

Round out your router

This kit offers a low-cost way to enhance your router's capabilities. Guide bushings in a variety of sizes team with a template to make decorative shapes. The edge guide expands the versatility of the router when you use nonpiloted router bits. *Router Roller Edge and Guide Bushing Kit. We ordered ours for $15.95 postpaid through Trendlines, 375 Beecham St., Dept. W, Chelsea, MA 02150 (catalog #VA23459).*

Continued on page 23

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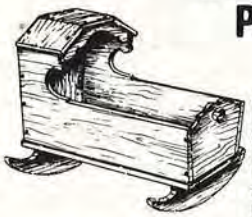

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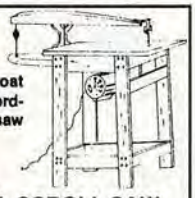

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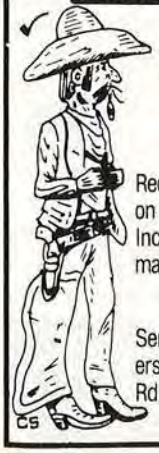

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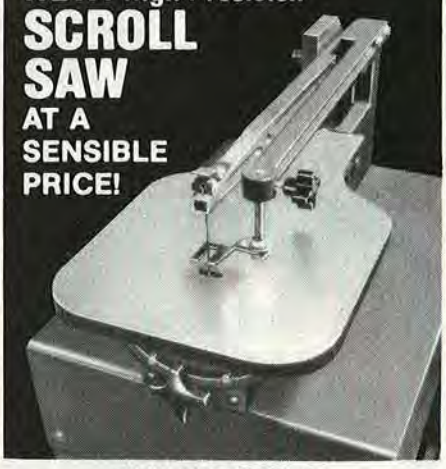

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Continued from page 20

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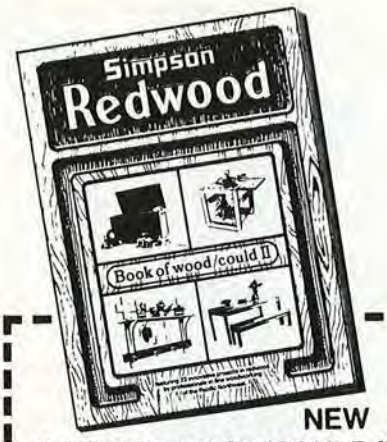

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WOOD ☑

Holiday Gift List

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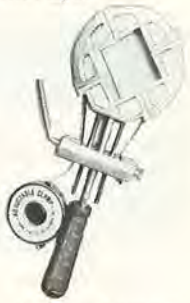

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☐ The Makita finishing sander, originally $79.00 is on sale for $43.00, from Tools on Sale™, a division of SEVEN CORNER ACE HARDWARE, 216 West Seventh St., St. Paul, MN 55102. 1-800-328-0457.

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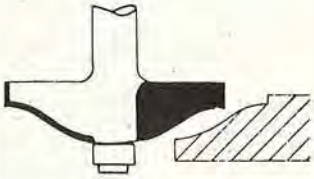

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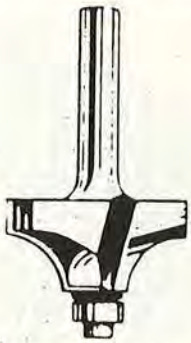

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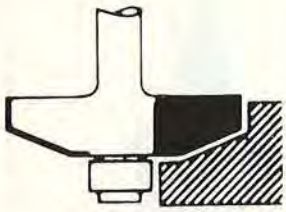

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☐ The Hegner Hobbymax, from Hegner's family of precision scroll saws, is ideal for the miniaturist, hobbyist, or model-maker. Smooth, square cuts without sanding, no vibration and rarely a broken blade are what make Hegner saws a joy to use and own. A special gift for a special someone, and it's under $500. Free information. AMI, P.O. Box 312, New Castle, DE 19720.

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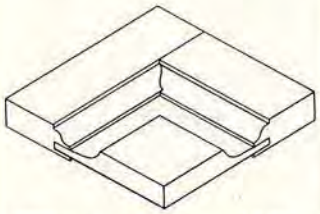

☐ The original Ogee DOOR SHOP™ as featured in WOOD MAGAZINE MAY/JUNE 85) is complete with style and rail, slot and panel raising bits for the ¼" chuck router. Bits are carbide tipped and BB and will make ¾"-2¼" thick raised panel doors, $89.50 ppd. ZAC PRODUCTS INC., 533 West 34 St., NY, NY 10001. Call 800-441-0101.

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☐ Excellent quality carbide-tipped ½" and ¼" shank router bits are offered at reasonable prices. Featured are carbide-tipped 6-pc. cabinet sets for $149.95, shaper cutters from $20 and a 3-pc. panel raising set for ½" routers at $149.95. For more information call 206-236-0272 seven days a week between 10 am and 7 pm. CASCADE PRECISION TOOL CO., Box 848, Mercer Island, WA 98040.

☐ The Woodworkers Organizer Unit comes complete with over 1,000 wood parts. Screwhole buttons, wheels, pegs, plugs, glue pins and plastic bins, $31.95 ppd. in USA. TIMBERS COUNTRY STORE, Carnelian Bay, CA 95711-0850. Catalog of wood specialties, $1, free with order.

☐ Combination pocket knife and precision rule. A very slim, two-bladed knife in a polished stainless steel case together with a 6" folding precision rule graduated in 64ths. Overall size 3" × ⅝" closed. Weighs only a few ounces. A wonderful gift. $29.90 ppd. GARRETT WADE CO., 161 Ave. of the Americas, New York, NY 10013.

Print this article

PECAN
the 'great spirit' hickory

Algonquin Indians of the southern Mississippi River basin region believed the pecan tree embodied the Great Spirit—perhaps because this one species provided so many of life's essentials. Pecan, a member of the hickory family, furnished nuts for eating, oil for cooking, and wood for implements and fuel. Pioneers, introduced to its bounty by the Indians, named this tree in honor of the Algonquin chief Peccan.

A North American native, pecan has been traced to the cretaceous period of 130 million years ago. Fossils found in Oregon and Washington prove that pecan was growing while dinosaurs roamed in what was then a much-warmer climate.

Once cherished for dining and living room furniture, pecan is now valued far more for its annual nut crop than its wood.

Pecan

Pecan lumber

Pecan-veneered plywood

Pecky pecan

Wood identification

Belonging to the genus *Carya*, which accounts for approximately 22 hickory species throughout North America, pecan is often cut, graded, and marketed simply as hickory.

Pecan *(Carya illinoensis)*, however, has a warmer, pink-tinted tone than does hickory. Its heartwood ranges from light to medium-tan in color and the sapwood tends to be cream-colored. "Pecky" pecan, showing the dark swirls and spots of limb buds and boring beetles, warrants special attention. With a tight, close grain, pecan wood may often show a pronounced wavy figure.

In forest habitat, pecan rarely reaches 100′ in height. Growing in the open, or in orchards, pecan trees may achieve 160′, but will have shorter, divided trunks with many upreaching branches (the better to bear nuts).

Working properties

If you've used hard maple successfully, you'll have no problem working pecan. The wood has remarkable strength, hardness, elasticity, and shock resistance—qualities some woods claim individually but that combine only in pecan. Because pecan possesses this all-around toughness, it can't easily be worked with hand tools—carbide-tipped cutters on power tools become a necessity.

While pecan shrinks considerably during drying, it remains fairly stable once seasoned. When dry, pecan weighs 42–52 lbs. per cubic foot.

Pecan bends with little effort and glues well, but its tendency to split necessitates pilot holes for screws and nails. The hardness of pecan translates into a wood that can be brought to a mirror-like finish.

Uses in woodworking

While 80 percent of all hickory goes for tool handles and rugged farm implement parts, pecan wood becomes quality office desks and chairs. It also finds its way into home wall paneling and commercial architectural veneers. For long-wearing chair parts—legs, backs, and rungs—pecan may be unequalled.

Cost and availability

Some large hardwood suppliers label pecan specifically. When it's mixed with hickory, you have to sort to find the pecan.

Pecan is available in boards up to 8″ wide and 8′ long. Pecan veneers are widely offered, too, but pecan-faced plywood may be harder to find.

You can buy pecan fairly inexpensively. A board foot of pecan can be purchased for about half the cost of the same amount of red oak, for instance, a fact that reflects pecan's diminished popularity as a furniture wood.

Sources of supply

Pecan grows primarily from southern Indiana southwestward into Texas. However, it has been successfully introduced into other mild-climate areas (Florida and Georgia, for instance) for its nut crop. ■

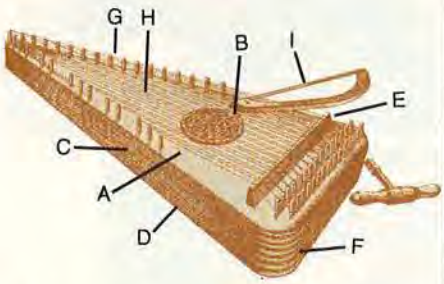
Photographs: Bob Calmer
Illustration: Steve Schindler

Print this article

For several months each year, the partners in Unicorn Strings relive the Renaissance, playing and selling their version of an age-old musical instrument.

A RENAISSANCE FOR HANDCRAFTED PSALTERIES

David Beede, 31, in center of photo at left, began handcrafting bowed psalteries simply because he loved to play them. Wood craftsman Gene Jaeger, 41, at right in photo, introduced his production know-how to the effort. And Jessica Jaeger, 40, Gene's wife, seated, added her talents for building and selling. Operating as Unicorn Strings, the three work much of the year in their rural Gainesville, Florida shop to make the unique folk instrument that they sell at annual Renaissance festivals. On the road from August through October together, then sharing shop space back home, these three from differing backgrounds have melded into an inseparable team that benefits from their multitude of talents.



On a bowed psaltery, primarily a melody instrument, the natural notes are on the right as it points away from you, the sharps and flats on the left. If you were to disassemble the $165 model above, here's what you would find (refer to outline drawing): (A) ¼" quarter-sawn sitka spruce soundboard; (B) sound hole with hand-carved cherry rosette insert; (C) 11/16" cherry sides; (D) ⅛" birch aircraft plywood back; (E) cherry string bridge; (F) 6/4 laminated hard maple pin block; (G) pin posts of nickel-plated steel; (H) light E-type steel guitar strings; and (I) curved cherry bow with polymer strings. At one side lies the tuning wrench.

Twelve miles north of Gainesville, down a rutted, sandy road gouged from the pine and live oak, a 12×55′ mobile home seems to slouch on its site. Somewhat aged and bent, its sheen long departed, the structure looks much like others in the north Florida backcountry. The Spanish moss brushing the roof, the outbuilding held erect only by its contents, and the scraggly cabbage palms poking out of the lush surrounding underbrush, betray little of the contemporary setting within.

Inside, a workshop glistens in hospital-like cleanliness. The walls and ceiling, painted white, brighten with the accent of yellow compressed air lines coiling on their way to designated work stations. Orderly stacks of wooden parts, rows of clamping fixtures, and a hardware-store arrangement of pins, finishes, and oddments mock the rural clutter outside.

Here, the bowed psalteries made by Unicorn Strings take shape. Glued and clamped, routed to form, drilled, sanded, finished, and pegged for strings, this revived version of an ancient instrument is readied for faraway Minnesota, Texas, and other places where Renaissance festivalgoers may likely buy them.

Selling psalteries at Renaissance fairs

Renaissance festivals, reenactments of fairs mimicking the atmosphere of 15th-century Europe, have proved the perfect backdrop for the bowed psalteries designed and made by David Beede and Gene and Jessica Jaeger. The bowed psaltery was a product of the flowering of art, music, literature, and science marking the end of the medieval period. Some say the bowed psaltery came from Germany; some cite tiny Estonia as its country of origin. Wherever it came from, the psaltery—with its resonant, slightly ethereal and haunting sound—fits Renaissance regalia.

David, Gene, and Jessica don bright medieval merchant costumes for these gala events and trick their tongues into Middle English speech for selling their wares—requirements set by show sponsors to fully carry out the theme. As David observes, "Renaissance festivals are like a stage—a three-dimensional one into which the audience walks."

Gene believes fairs of this type fit the instrument perfectly. "It's an ideal environment. Customers know what the Renaissance is, they know what to expect, and the instrument looks right in it."

That's why Renaissance festival visitors have become the prime market for bowed psalteries. The three partners participate in two major fairs each year—the Minnesota Renaissance Festival in Shakopee and the Texas Renaissance Fair near Houston. Each runs for seven consecutive weekends near the end of summer, and scheduling happens back-to-back, so David, Gene, and Jessica make their home on the road for 14 straight weeks. Fairs close to home in Largo and Sarasota, Florida, round out their schedule.

With the festival circuit completed by fall's end, the team returns to Gainesville and begins manufacturing instruments to fulfill orders in hand, expected holiday orders, and stock for next season. During this off season, they'll often put in 40-hour weeks building psalteries.

How Unicorn Strings came to be

Like the Renaissance, which heralded a new era, the Unicorn Strings partnership of David, Gene, and Jessica began a satisfying lifestyle and change from the past for each of them. Bowed psalteries, and the fine-tuned technique of making and selling them, first drew the three together and now holds them in place. As David remarks: "We're like a three-legged stool—it wouldn't work without all of us."

David, experienced in wood, tools, and custom craftsmanship, says the only thing he lacked was a sense of efficiency before meeting Gene five years ago. David also knew folk music thoroughly and

Continued

had built his first instrument, a banjo, when he was 18 years old. Prior to the formation of Unicorn Strings, David listed among his pursuits rehabilitation counseling, playing dulcimer, teaching dulcimer, building dulcimers and other instruments (on custom order, an instrument might take him one month to make), and singing folk music. He had discovered the psaltery at a dulcimer festival, where he took measurements to build his first one. Then, he worked to perfect it until the present instrument evolved.

Gene Jaeger's background in design and carpentry, a stint as a shipwright, and a flair for production presented to David the opportunity to build bowed psalteries—lots of them. Says David: "When I met Gene, he said we could build 50, and I said it would take years to sell that many."

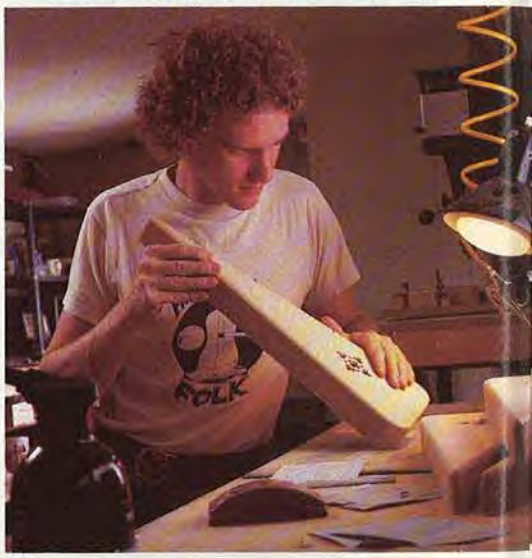
Jessica became a full-time partner in the enterprise after demand for the instruments picked up. The daughter of professional designer-craftspeople, Jessica knew her way around a wood shop, but had been working in adolescent drug prevention to help with finances. She began as the business manager; now she sands, drills pin holes, and matches woods.

Besides their shop skills, all three have sales talents, too. David relates to potential buyers, who may be musicians or play other instruments.

Gene, who had to quickly learn the first line of "Greensleeves" on the psaltery just prior to their first fair, has the nerve to urge people to play. And Jessica, with her counseling experience, relates well to the disabled and enjoys children.

The cottage-industry approach to production

"As the Unicorn name implies, bowed psalteries are somewhat unique," David notes. "But in the Middle Ages, there *were* unicorns. Goats' horns, for instance, were surgically grafted to form one. These animals assumed leadership of their herds and were much sought after. Hopefully, this leadership and



Gene assembles the instrument body by mounting the top, sides, and back in a two-piece clamping fixture. He spreads Titebond on the parts with a small paint roller, then bolts the halves together.

Routing the outside of the instrument leaves a smooth surface requiring relatively little sanding. David does any necessary sanding on the soundboard and sides under the light of an incandescent bulb, which produces more shadow to detect rough spots. Note the air hose for blowing dust.

Stringing and tying off 30 steel wires to the pins happens to be a job Jessica likes. After stringing, the psalteries are tuned with help from an electronic keyboard.

uniqueness applies to the instruments we make."

Most folk instruments, according to David, are naturally individual. "They're not only played by ear, but built by ear." When David built them by himself, that's how his instruments were made.

Now, in the mobile home workshop outside Gainesville, psalteries have become production instruments. Not in the factory sense of building without care or feeling, but in the cottage-industry sense of building with quality while reducing wasted effort and time-consuming hand labor where possible.

Following their credo—"Jigs make precision instruments"—they have geared up the production effort. Once ripped, and power-planed to thickness in a small outbuilding, psaltery parts pass into the main workshop for assembly and finishing. From gluing and clamping the psalteries together in two-part forms, to shaping the instruments on the router table, then drilling the soundhole and string pin holes, the three use various jigs and fixtures that ensure precision. The hand-built quality of custom work remains, but many formerly laborious tasks have been reduced or eliminated.

Finishing for perfect sound

Sanding and finishing, the all-important steps many woodworkers dread, must be impeccable on a psaltery. "The surface is where the instrument meets the public," David states, "but that doesn't necessarily mean lots of sanding. If you can cut it smooth, do it, so you don't have to abrade wood. "That's what he does in the workshop with a 2-hp. router mounted in a table and fitted with a large bit specially machined from a hand plane blade to take 1/16" off the edges of the instrument body after it's glued up. The sharply cut surface requires only minimal sanding.

Finishing psalteries, and other stringed wooden instruments, differs from other woodworking projects. The old adage "what you do to one side you have to do to the other" doesn't apply. According to Gene, "finishing both sides has never been the case with musical instruments. You can't finish the inside, because the wood needs to breathe in order to remain flexible."

On a psaltery, for instance, the soundboard (top piece) must vibrate to produce sound: the string first vibrates when touched by the bow, which in turn vibrates the bridge. Then, the bridge vibrates the soundboard. "A smooth, hard finish on the soundboard gives a brighter sound," Gene advises. Too many coats would cause it to stiffen. Likewise, a penetrating oil would dull the sound by affecting the resonance of the wood. Moisture, he says, can't be sealed out by finishing the inside; it has to work its way in and out of the wood slowly through the soundhole. Movement of the wood is restricted by the instrument structure, which is built to withstand the more than 450 pounds of force the strings exert down its length. Gene adds that in the five years they've been making and selling psalteries, only one has been returned.

Adhering to these finishing principles, David sprays each psaltery with two coats of Rudd commercial lacquer before attaching the cherry string bridge. Then, he uses Watco oil on the bridge. Why not lacquer, too? "Because the strings would dent a surface finish like lacquer, eventually affecting their vibrating ability," David replies.

The perfect finish, like many of the techniques the three have developed, resulted from trial and error. "We first tried a coat of sanding sealer on the instruments, then a final coat of lacquer," notes Gene, "but two coats of spray lacquer turned out to be easier and more durable." With their production orientation, the lacquer comes from three-gallon pressure pots rather than the smaller siphon cup normally used with a spray gun.

Continually refining the product

"Sometimes," David tells us, "a concept comes to Gene, Jessica, or I that revolutionizes our whole approach." Take the cherry used to construct the psaltery sides, for example.

At first, they purchased 4/4 stock from a nearby country sawmill. Ungraded, the wood received ranged from top quality to common and below—"real run-of-the-mill," as Jessica describes it. Despite the wood's low cost, they found they were actually losing money because of all the waste in unsound knots, cracks, and splits. Now, they buy quality FAS cherry from a northern supplier.

The hard maple once used for the pin blocks was another learning experience. Even strong, solid maple they knew would split under string tension after 30 pin block holes were drilled. So, instead of solid stock, they turned to laminated maple available from a manufacturer of piano parts.

David can laugh about another experience now, but his initial bow assembly method was truly frustrating. "I used 30 horse hairs in the bow 'string' and tried to slip them into the holes at each end as a group, but a few never made it. I'd spend a long time trying to poke through the strays," David recalls.

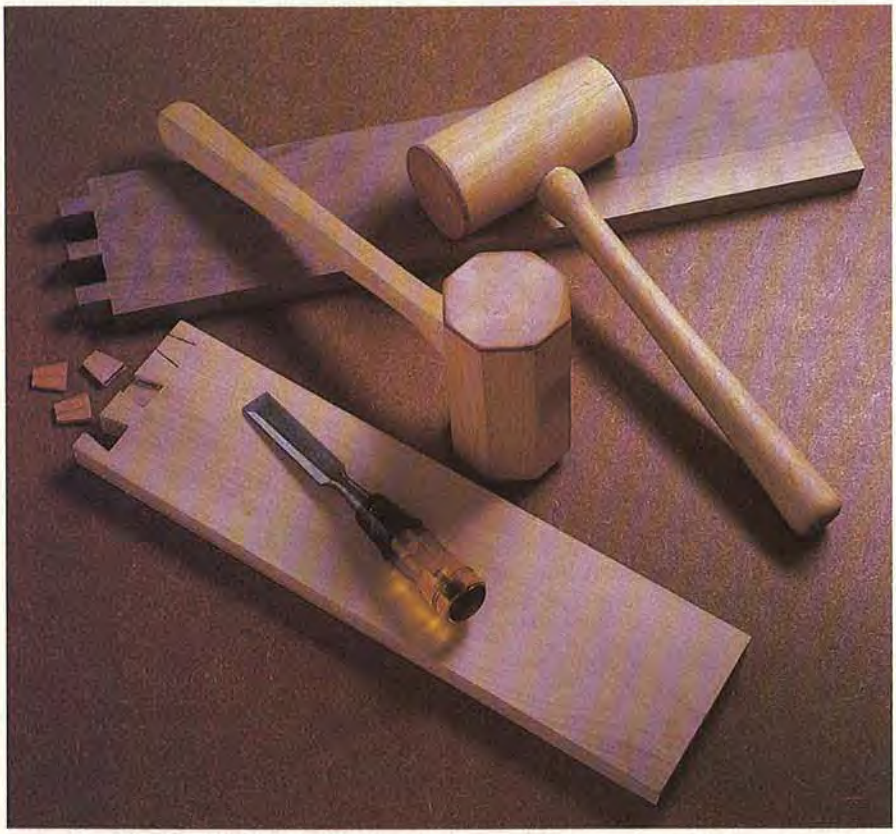
Now, the bow strings have entered the modern world—they're presently made from strands of polymer to resist shrinking and stretching from humidity changes and inserted as a unit.

Changes such as these have not only improved product quality, they have lowered production time and removed frustration from David, Gene, and Jessica's workshop hours.

Gene, always seeking more efficient methods, doesn't want to substitute machines for craftsmanship no matter how much time they save. He summarizes his and his partners' philosophy this way: "We are woodworkers rather than business managers, so our choice is to stay small and efficient. Then, we can continue to do the work ourselves." ■

Produced by Peter J. Stephano
Photographs: Wm. Hopkins, Jr.
Illustration: Jim Stevenson

HARD MAPLE WOODWORKER'S MALLETS



It's no accident that skilled woodworkers everywhere count a wooden mallet as one of their most trusted tools. It has literally dozens of uses in the shop—from nudging home a tight-fitting joint to driving a chisel, and lots of things in between.

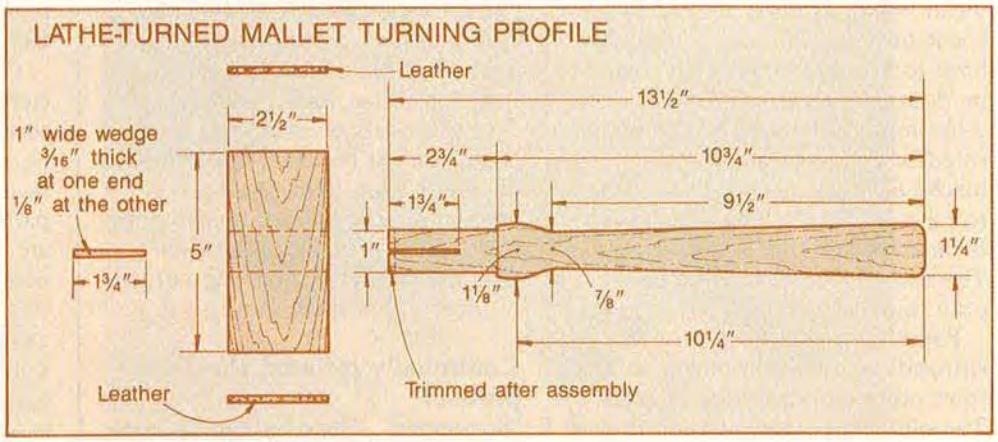
Both of our custom mallets feature large leather-protected striking surfaces that dampen and diffuse contact over a large area. We show you how to fashion the version with the octagonally shaped head using a table saw and a few hand tools. The other, a design alternative if you like lathe work, closely resembles the first in construction. Refer to the Lathe-Turned Mallet Drawing, *below*, as your guide if you choose this variation.

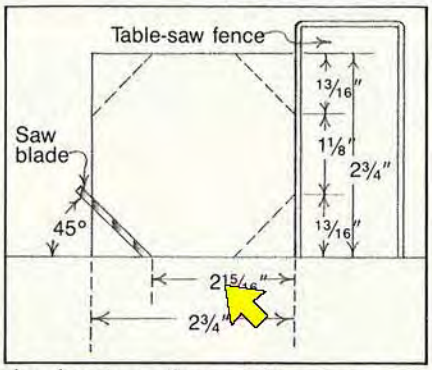
Note: You'll need thick stock for the mallet heads and handles. You can either laminate thinner stock to size or purchase turning squares. See the Buying Guide for details.

1 Rip the mallet head (A) to 2¾×2¾" and crosscut it to length. Find and mark the center point of one of its edge-grain sides. Using a 1" spade bit, bore a hole into the head at the center point, stopping when the point of the bit just protrudes through the opposite side. Turn the piece over and finish boring the hole (doing this prevents chip-out).

2 Carefully chisel the hole in the mallet head to form a 1¼×1" rectangle, working from both sides to avoid chip-out.

3 To transform the square stock into the octagonal shape, first tilt the blade on your table saw to 45° and set the fence 2 15/16" away from the base of the blade as shown in





the drawing, *above*. Then, using a push stick, feed the stock along the fence and bevel-rip the edges.

4 Chamfer the edges of one end of the mallet head (the other end will be covered with leather and should not be chamfered).

5 Rip and crosscut the handle (B) to size. Cut a pair of ⅛" deep recesses 3" long to form the handle tenon as shown in the Octagonal-Head Mallet Drawing. (We used a table saw, miter gauge and a dado blade to make the pair of recess cuts.) Make sure the handle tenon fits snugly in the hole in the mallet head. With a band saw or jigsaw, cut the handle to shape as indicated in the drawing. Then, use a spokeshave or scraper to make bevel cuts on the edges of the handle as shown in the photo, *below*.

Bill of Materials

Part	Finished Size*			Material	Qty.
	T	W	L		
A	2¾"	2¾"	5"	maple	1
B	1¼"	1¼"	13½"	maple	1
C	3/16"	1"	2"	maple	1

Supplies: epoxy, tung oil, paste wax, leather

6 With a fine-toothed hand saw or a band saw, cut a ⅛" slot 2" long to house the tenon wedge in the recessed end of the handle.

7 Fashion a wedge (C) from scrap maple. Then spread glue on the tenon and in the hole in the mallet head, and insert the handle into the hole. Now, run a few beads of glue into the slot in the handle, cover the wedge with glue, and tap the wedge snugly into position (this will be the last time you'll have to use a hammer for this type of operation!). Remove the excess glue, and, after the glue dries, carefully saw off the excess material protruding through the head.

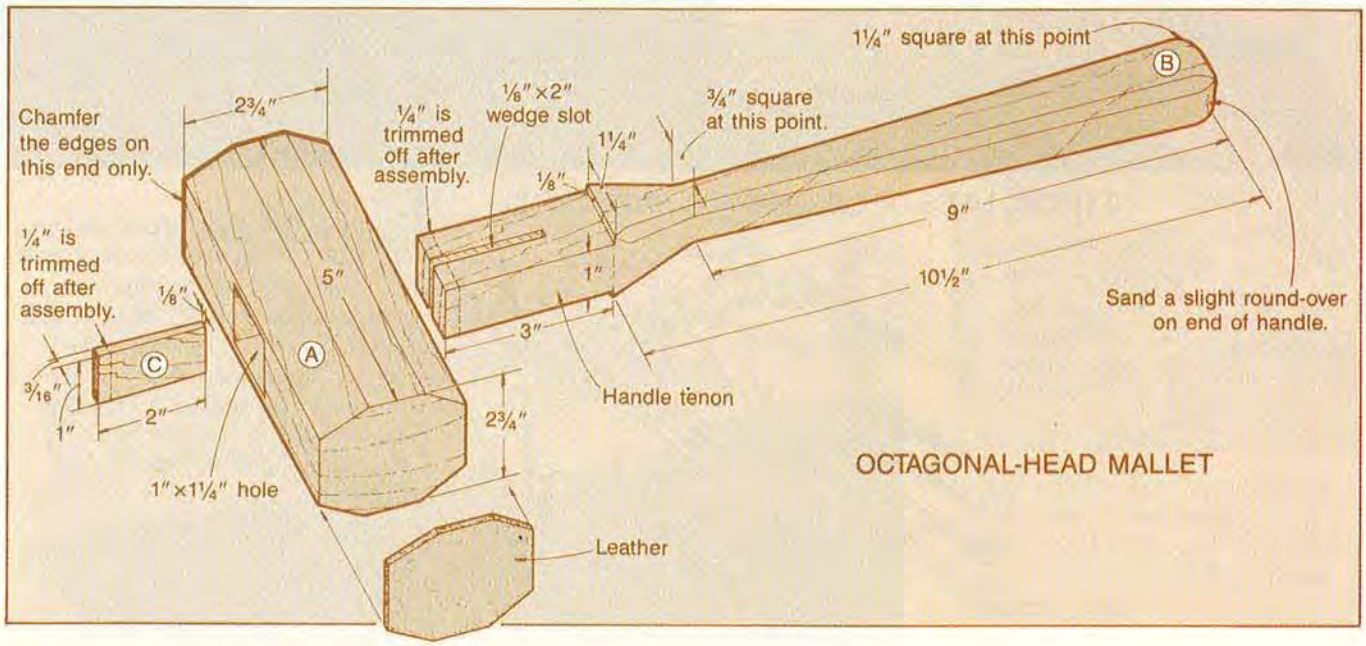
8 Finish-sand the entire mallet. Then epoxy and clamp the leather in place *opposite* the chamfered end. When the epoxy dries, trim the leather flush with the edges of the head with an X-acto knife. Finish the mallet with tung oil followed by a couple applications of paste wax.

BUYING GUIDE

● ***Turning squares.*** Maple 1½×1½" (18" piece required), $1.05; 3×3" (12" piece), $3.10. Constantine, 2050 Eastchester Rd., Bronx, NY 10461 (or order toll-free 800-223-8087).

● ***Leather.*** 3½" leather Rounders, 35 cents each. Tandy stock #4126. Call 800-433-5546 for the store nearest you, or write Tandy Leather Company, P.O. Box 2934, Fort Worth, TX 76113. ■

Project Designs: Jim Boelling
Photographs: Hopkins Associates
Illustrations: Bill Zaun



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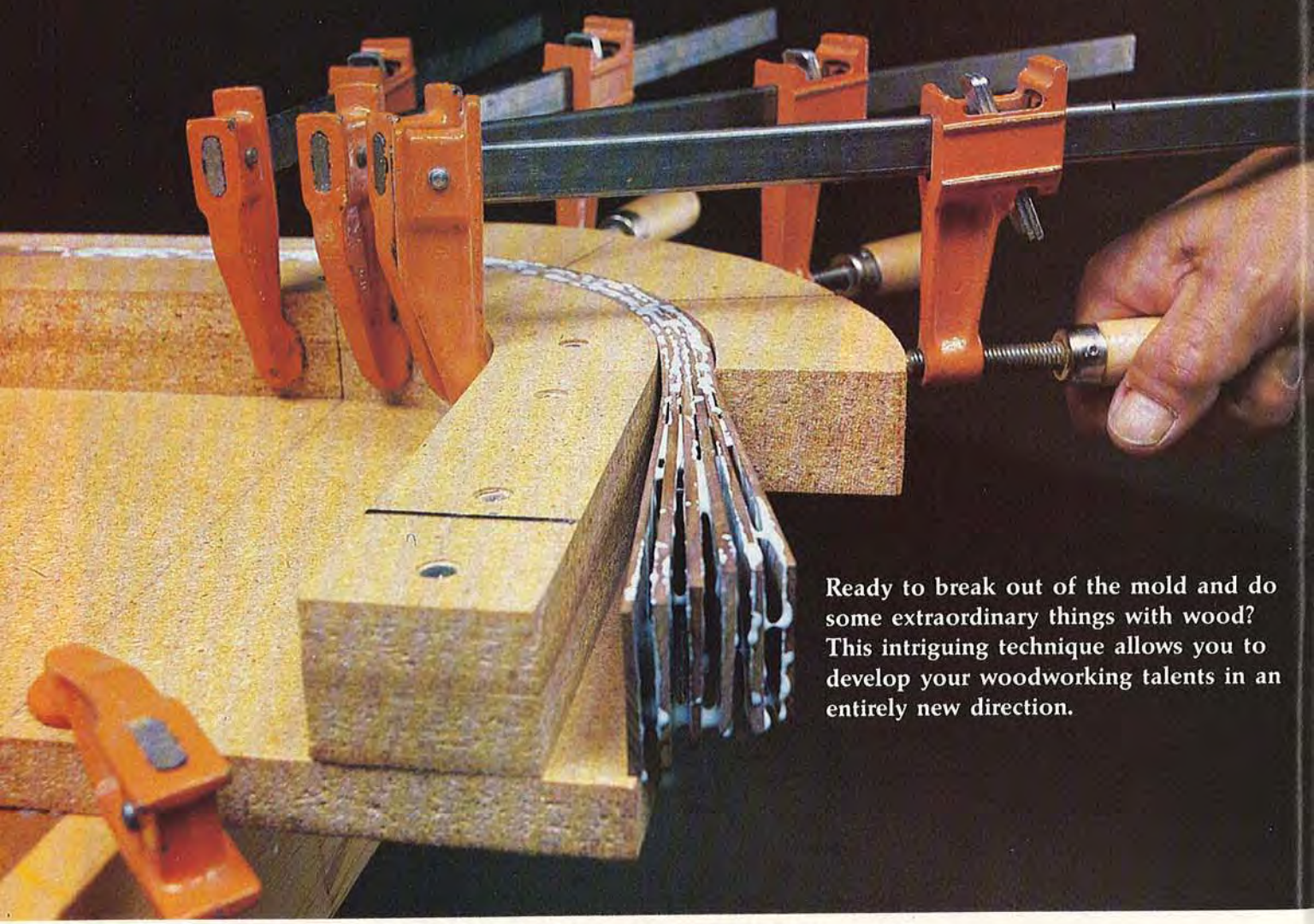
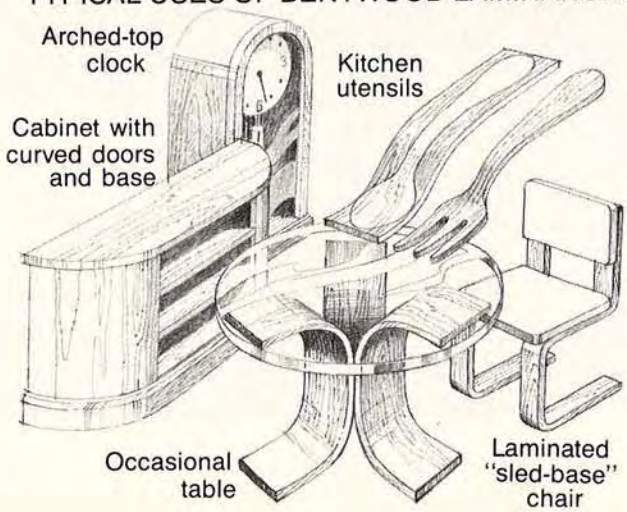
HOW TO BEND LAMINATED WOOD



Ready to break out of the mold and do some extraordinary things with wood? This intriguing technique allows you to develop your woodworking talents in an entirely new direction.

TYPICAL USES OF BENTWOOD LAMINATIONS



From the time most woodworkers put a saw to that first board, they're continually told of the importance of things being square, straight, and properly aligned. That's good advice, and remembering it will serve you well in the majority of your experiences as a woodworker.

But sometimes, in order to achieve the desired result, you need to be able to make wood conform to an irregular shape. The various projects illustrated at left are but a few of the many such situations you may encounter.

2 DIFFERENT APPROACHES TO BENDING SOLID WOOD

You can bend solid stock either by *steaming* the wood and then bending it around a form or by *laminating thin strips* together with glue and clamping the strips to a form. We prefer laminating for several reasons.

First, the results are much more predictable. All bent wood wants to spring back to its original configuration, but the glue holding laminated strips together, in large measure, prevents this from happening. With steam-bent wood, you can never predict the results.

Second, laminated bent wood has much greater strength than does its steam-bent counterpart. And third, thin-strip laminating allows you to produce near-duplicates of the first piece, an advantage that you can't achieve easily with steam-bending.

We think that after reading this article you'll agree that thin-strip laminating is definitely one technique you want to try. The technique itself is easy to employ, so it's not something you should shy away from for that reason. However, it does require some up-front knowledge about how to select the right board for bending, how to saw the strips that will be laminated, and how to make forms.

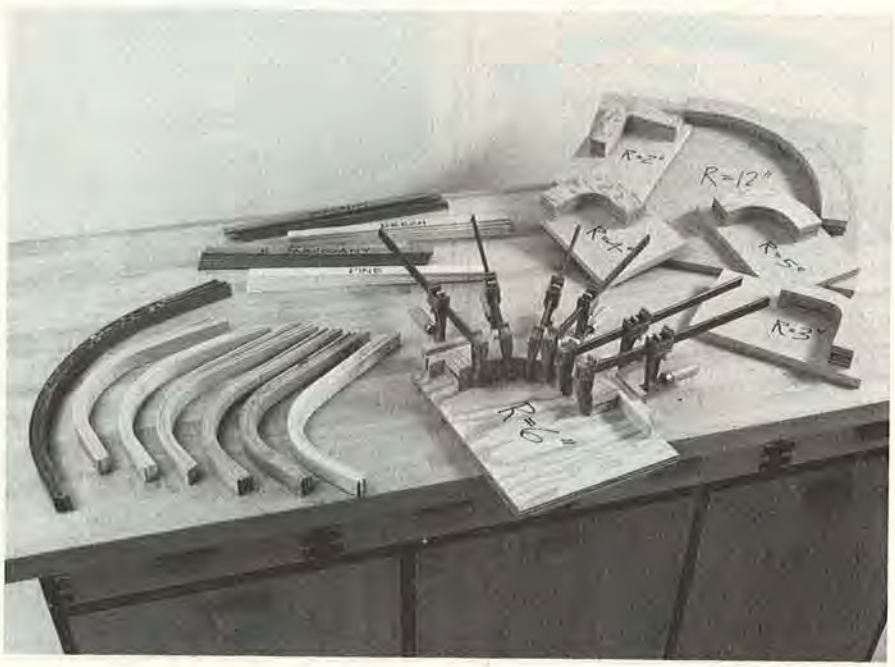
TIPS ON SELECTING THE RIGHT WOOD AND GLUE FOR BENDING

Every wood species has characteristics that make it unique. Some woods are more dense than others, some work with greater ease, and not surprisingly, some bend more successfully than other species.

We were curious to find out how well several species we had on hand would bend. Though the test could hardly be called scientific, we did make some findings we think are interesting. We ripped ⅛" thick strips ¾" wide from 13 boards (each a different species) and bent them around curves with various radii.

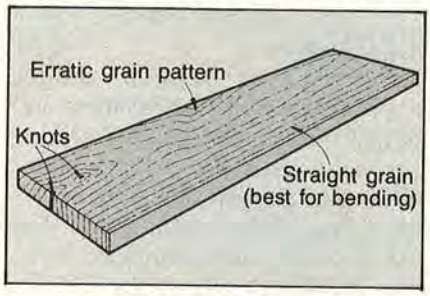
In general, we found that the native hardwoods bent to the tightest radii, followed by the softwoods, and then the exotics. The overall champ was red oak (3" radius), followed closely by white oak and pecan (4"), cherry, maple, and beech (5"), birch, ash, walnut, and ponderosa pine (6"), sitka spruce (7"), Honduras mahogany (8"), and teak (12"). The exotics repeatedly broke without warning (without first splintering and cracking). The photo below shows some of the species before, during, and after being bent.

We also found that if we dry-clamped the strips around a form and let them stay that way for several minutes before gluing and clamping, we could bend them more tightly than was otherwise possible. Some species also demonstrated much better *memory* (ability to hold their shape after dry-bending) than others.



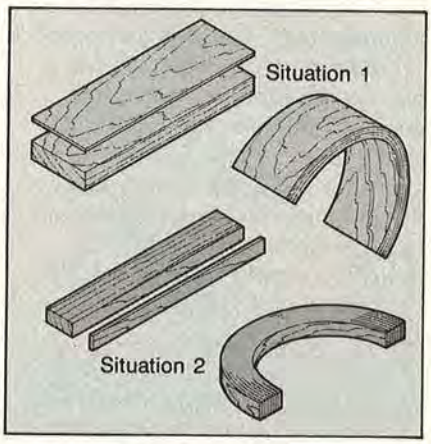
Choose your boards carefully

How successful you are at bending laminated wood strips has a lot to do with how picky you are when selecting boards to use. Because bending places a lot of stress on wood, you want to choose boards that are free of defects such as knots and erratic (contorted) grain pattern. Oftentimes, you have a situation like that shown below where one part of a board may be totally



unacceptable for bending and the other part just right.

It's important to cut your strips from a board so that the straight grain follows the direction of the bend. The sketch below shows what we mean. In situation 1, you



would want to slice strips from one of the faces of the board. But in situation 2, for the greatest strength you should rip material from one of the board's edges.

Just in case you're sitting there

Continued

thinking we might be making too big a deal out of the importance of grain direction, we thought we'd show you the close-up below. It clearly demonstrates what usually

happens if the grain runs across the length of the bend rather than parallel to it.

The glue you use makes a difference

Just as you want the right board for a given bending situation, there are certain times when the type of glue you select can make or break your effort. We've used four different types since we've begun experimenting with laminated-wood bending. And here's what we've found.

If you're involved with a large-scale project that won't be exposed to moisture, use *polyvinyl acetate (white) glue.* It's strong enough to do the job, and its long open time allows you to complete the lamination before the glue sets. Conversely, to reduce glue-up time, go with *aliphatic resin (yellow) glue.*

And for projects that call for a waterproof adhesive, we've had good success with *resorcinol* and *epoxy* glues. These last two glues also have good gap-filling properties, an important characteristic on larger projects where it may be difficult to apply sufficient clamp pressure to close all joint lines.

Note: If your project involves exotic woods, which tend to be oily, make sure you choose resorcinol or epoxy. Neither white nor yellow glue will work well. And if you're laminating flexible (1/64") veneer, you must use epoxy to stabilize the lamination. With other glues, the veneer will remain flexible.

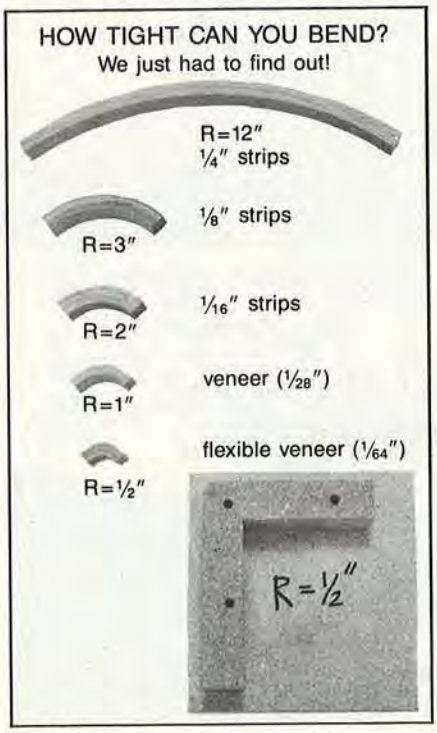
HOW TO PRODUCE WOOD STRIPS FOR LAMINATING

Rarely is it practical to bend wood strips that are greater than ¼" thick. So you've either got to rip or resaw material you have on hand to the needed thickness or purchase what you need from a mail-order supplier. You lose control of grain direction with purchased stock, but we've worked successfully with it.

The project itself determines how thick the strips should be

As a general rule, the thicker the strips you use, the greater the control you have during the bending process. That's because you're dealing with fewer strips, and consequently fewer machining inaccuracies. But the reality of the situation is that to negotiate small-radius bends, the strips sometimes have to be 1/16" or even thinner.

To provide you with a yardstick by which you can determine the proper thickness of strips needed for a given project, we conducted another experiment. Using red oak as our representative sample, we bent ¼", ⅛", 1/16", veneer (1/28"), and flexible veneer (1/64") to the tightest radius possible. The photo below shows the results we achieved.



These and the earlier conclusions we made about the relative bendability of various species should help you make your decision.

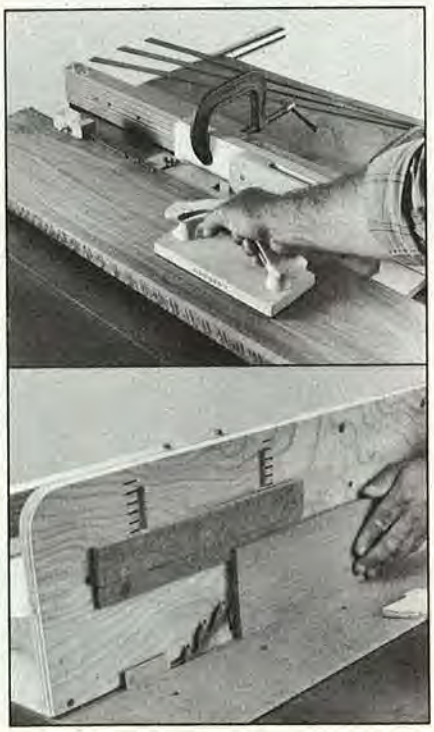
3 ways to saw your own strips

Here again, the project you're making dictates which method makes the best sense to use. For narrow strips no less than ¼" thick, you can rip the needed stock from the edge of a board.

However, if you need narrow strips less than ¼" thick, use our thin-strip ripper as shown in the photo below. This device prevents strips from getting banged up by the saw blade after they have been cut.

Wider strips call for a different strategy. And that's where the resawing jig shown in use at the bottom of this column comes into

Note: We show how to build the thin-strip ripper in the August, 1985 issue of *WOOD*, page 64 and the resawing jig in October, 1985, page 45. If you don't have these issues, drop us a line and we'll send you a copy of the articles. Enclose a stamped, self addressed, business-sized envelope.



play. It's similar in function to the thin-strip ripper.

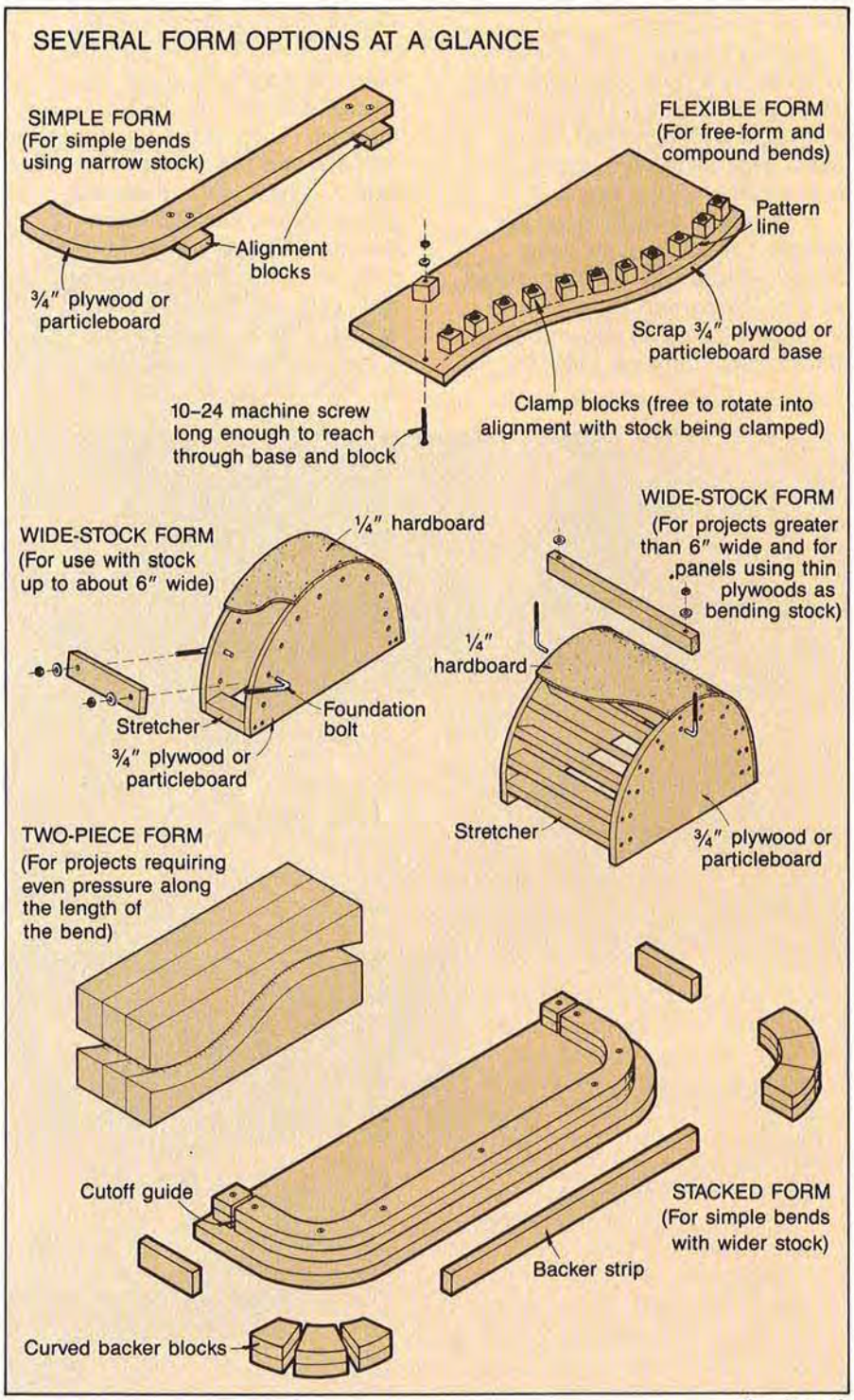
With projects that demand that you bend to extremely tight radii, you will have to go with veneer or the even thinner flexible veneer. You can cut flexible veneer to width with a straightedge and a sharp utility knife. But with standard veneer we've had good luck stacking several pieces atop one another, sandwiching them in the jig shown below, and running them through the table saw.

Pointers to remember when sawing thin strips

- Always cut the strips a few inches longer than you need because they have a tendency to shift lengthwise during clamping. This shifting can cause a shortage of material at one or both ends.
- Cut the strips about ¼" wider than the finished width. Doing this allows you to compensate for any lateral movement of the strips during clamping.
- If it is important for the finished piece to look like solid stock, be sure you keep track of the order in which the strips come off the board. One of the best ways to do this is to number them. Laminating them together in their correct sequence will minimize the impact of the joint lines between each.
- Before cutting strips, make sure the saw and the jig (if you use one) are set up correctly to make uniformly thick strips. Otherwise, your lamination will twist and distort.
- Bend the strips soon after cutting them. The strips will become more brittle the longer you wait.

MAKING THE FORM—AN INTEGRAL PART OF THE PROCESS

To make your thin strips conform to the desired shape, you need to build a form. In broad terms, there are only two types to choose from—one-piece forms and two-piece forms. We show both types (including several variations of the one-piece type) below. For most situations, except those requiring extremely even pressure along the length of the mold, one of the one-piece forms will do the job. Here again, the project determines the form's shape, size, and configuration.


SEVERAL FORM OPTIONS AT A GLANCE
SIMPLE FORM
(For simple bends using narrow stock)
Alignment blocks
¾" plywood or particleboard
FLEXIBLE FORM
(For free-form and compound bends)
Pattern line
Scrap ¾" plywood or particleboard base
10–24 machine screw long enough to reach through base and block
Clamp blocks (free to rotate into alignment with stock being clamped)
WIDE-STOCK FORM
(For use with stock up to about 6" wide)
¼" hardboard
Stretcher
Foundation bolt
¾" plywood or particleboard
WIDE-STOCK FORM
(For projects greater than 6" wide and for panels using thin plywoods as bending stock)
¼" hardboard
Stretcher
¾" plywood or particleboard
TWO-PIECE FORM
(For projects requiring even pressure along the length of the bend)
Cutoff guide
Backer strip
STACKED FORM
(For simple bends with wider stock)
Curved backer blocks

Continued

How to transfer a pattern onto the form

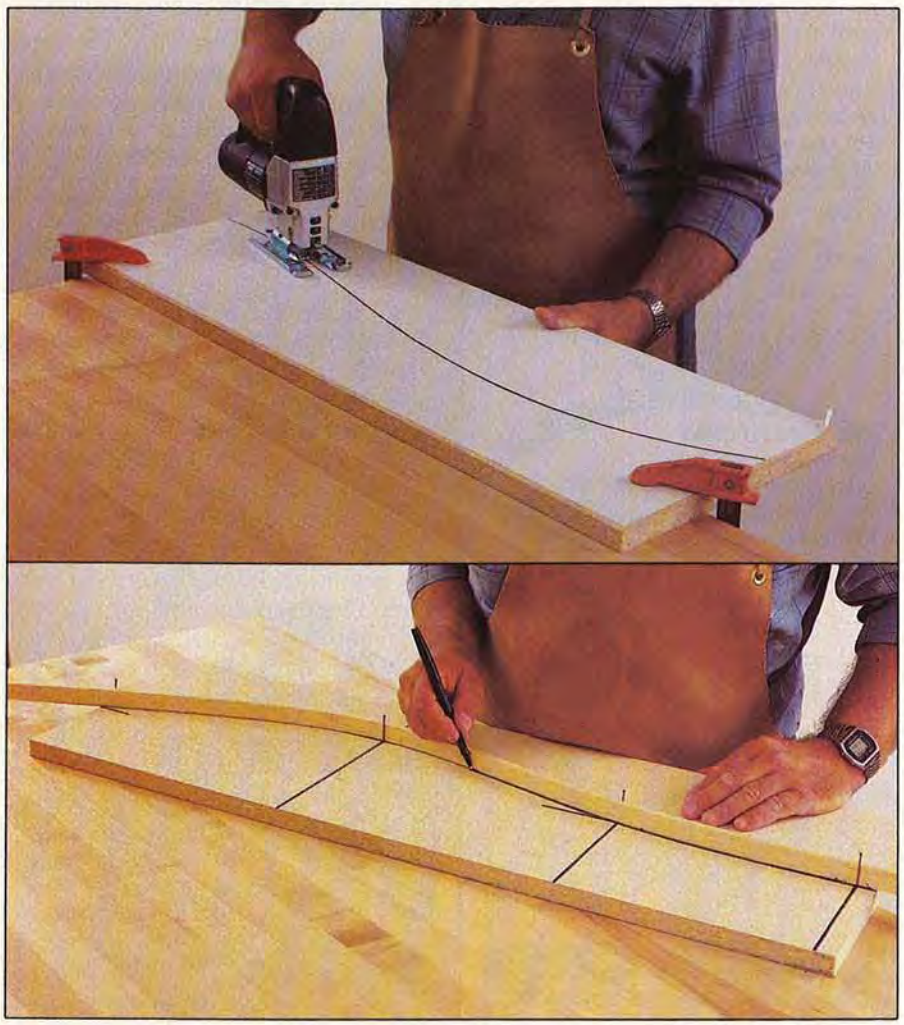
Unless you design your own projects, you'll be working from a furnished plan or a set of drawings. And unless you've been provided with a full-size pattern, you've got to enlarge and then transfer the shape to the form material. Often, you'll be given a grid pattern or a plotted point pattern.

In both of these cases, purchase or make your own graph paper to the scale called for. Then, transfer the points of intersection to the graph paper, and draw in the lines between the various points.

If you don't plan to re-use the pattern, just apply some spray-mount adhesive to the form material, glue the pattern to it, and cut the desired shape as shown below. But if you're thinking you may want to make several of the same item, get yourself some dressmaker's carbon and transfer the shape onto the form that way.

How to create a smooth curve

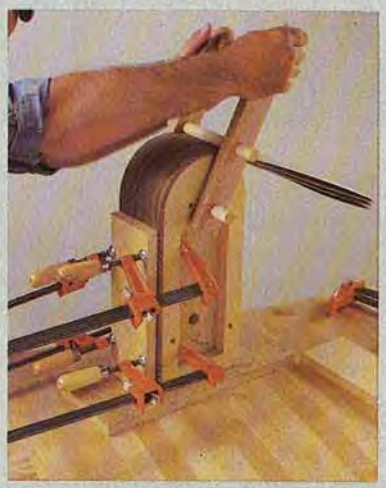
Some projects call for parts that curve gently over their entire length. In these instances, you can use the technique shown at the bottom of this page to obtain the result you want. First, plot the points at which the stock will change direction on the form material. Then, drive a series of finish nails into the form so that the strip will intersect at these same points. Now, thread a length of thin stock (on edge) around the nails, adjusting the intermediate nails until you have the curve desired. Then, mark the line of the curve on the form material.

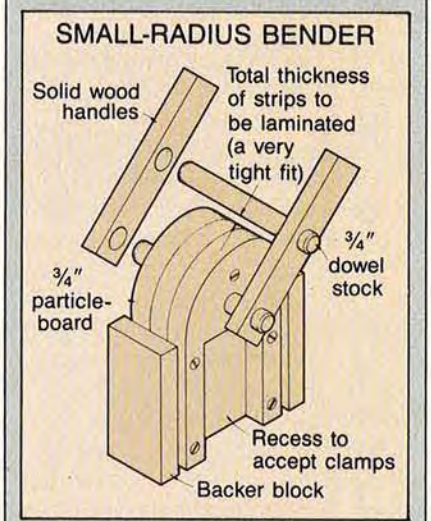


A nifty jig for clamping small-radius corners

It's never easy to bend laminated wood around a tight corner. Why? Primarily because small radii don't allow you sufficient room to place your clamps closely enough together to ensure adequate pressure along the entire length of the curve. Embarrassing gaps between the laminations usually result.

But the idea behind the jig shown below eliminates most all the problems you would otherwise experience. Basically, it's a press that forces the wood around the corner and holds it in position until the clamps and clamping strips beyond the turn capture the wood. You can adapt this principle to many bending situations.





GET READY . . GET SET . . GLUE

Because time is of the essence after the glue has been brushed on the wood strips, you've got to have everything on hand and well organized before you begin. Photo 1 below shows you what we're talking about. You'll want to have plenty of clamps at the ready, the work surfaces protected, and the form protected from the glue (you can use waxed paper for this or coat the form with paste wax).

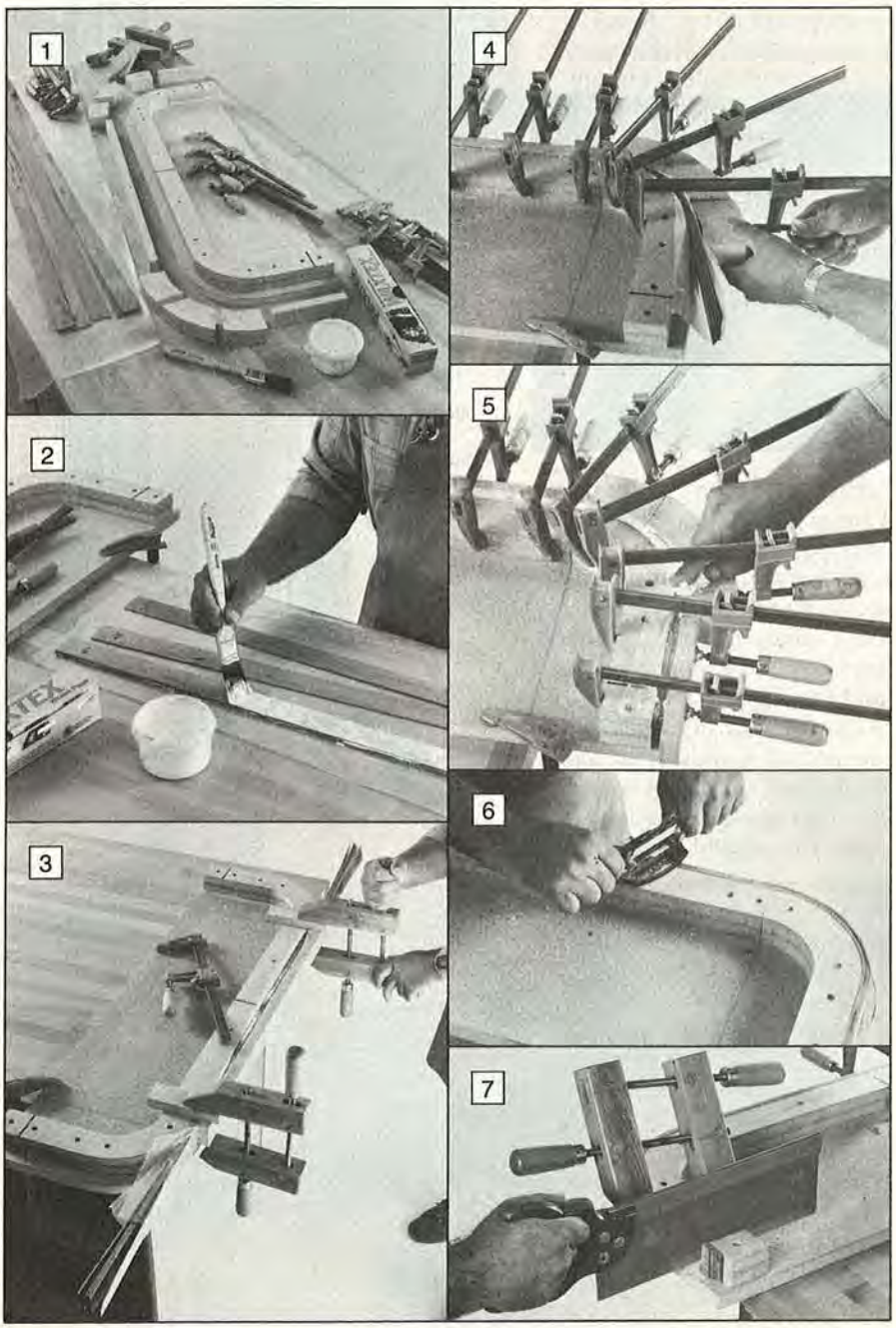
Gluing and clamping the lamination

We like to lay out the wood strips in the order in which we cut them, as shown in the photo 2. Then, we apply a liberal coat of glue to both sides of each strip (except the top and bottom strips) and stack them.

Next, we arrange the strips along the form and begin clamping—see photo 3. (Note that the centerpoint of both the form and the strips have been marked.) To minimize any twisting of the strips as they go around a curve, we clamp an alignment block at both ends of the straight section of the form. Then we begin clamping at the center and work our way toward the curved sections. (You can figure on having to place a clamp about every 3–4″ along the lamination's length.) Notice the clamping strip we used for even pressure.

We've found that when clamping around curves, we're a lot better off when we finesse the strips rather than try to bully them into submission. Say, for example, if we use three clamps to turn the corner, we get all of them started and then tighten them gradually and evenly. Notice in photo 4 that we also use curved clamping blocks. These allow us to maintain constant pressure over the entire area being glued. You may need the alignment blocks when negotiating curves.

Once the clamps have been tightened and the strips are fully together, we remove as much of the glue squeeze-out as possible (see photo 5). Doing this messy job before the glue sets up makes finishing the edges of the lamination much easier. We usually use a putty knife and an old rag to remove the glue.



Truing up and trimming the lamination

After letting the glue dry overnight, we loosen the clamps and take the lamination out of the form and inspect it. If the piece is suitable for use, we then return it to the form and clamp it so the top of the lamination is slightly above the form. This allows us to use the form to steady the lamination as its edges are being trued. We've had good luck using a belt sander, plane, and a cabinet scraper (see photo 6).

With the lamination still clamped to the form, we trim the ends of the lamination, using the cutoff guide to guarantee a correct cut—see photo 7. And when that's done, we remove the clamps and sand the lamination smooth. ■

Photographs: Bob Calmer
Illustrations: William Zaun

Print this article

Hang it all!
OAK COAT-TREE

Now that you're wise to the tricks of the bentwood lamination trade (thanks to the preceding article), head for the shop and apply what you've learned. You won't find a better test project than this sturdy coat-tree, with its curved uprights of resawn oak strips. Be sure to save the bending form when you're finished—you can bet that someone will be asking you to make a duplicate coat-tree for *their* house.

BUILDING THE FORM

1 Cut the pieces for the form to size and shape as dimensioned in Bending-Form Drawing. Glue and stack the particleboard strips to form the sections used to shape the upright (A, B, C, and D). Sand the surface of the particleboard that will come in contact with the oak strips smooth and screw the sections to the particleboard base.

2 Using a fine-toothed handsaw, cut through the particleboard strips to form the cut-off guides shown in the drawing. (The guides will be used later for trimming the ends of the laminations.) Chamfer both ends of the base so they run parallel to the strips.

LAMINATING THE UPRIGHTS

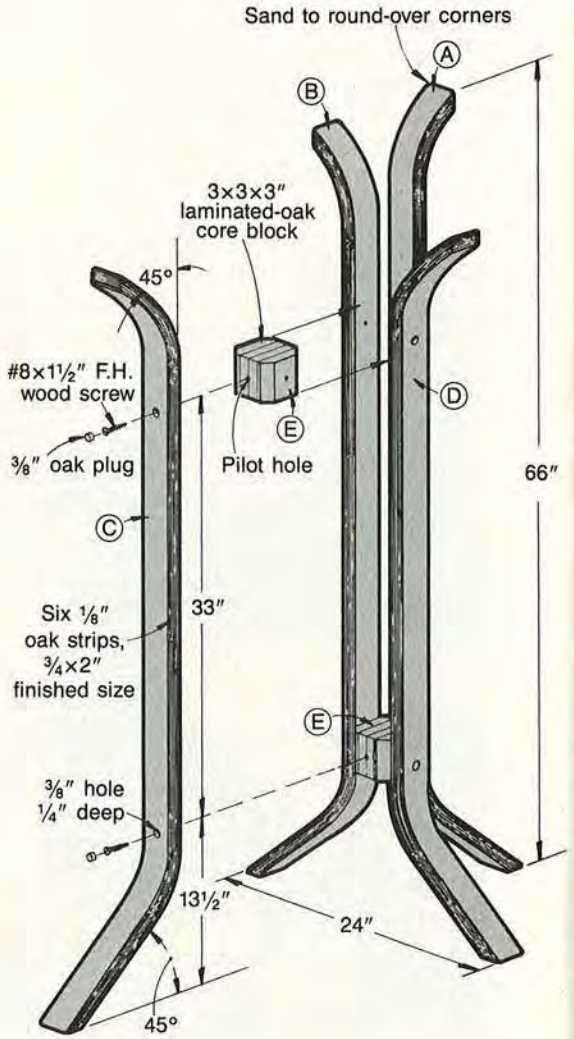
1 Rip ten 2⅛"-wide strips from ¾"-thick oak stock that's at least 7' long. Crosscut the 2⅛" strips to 78".

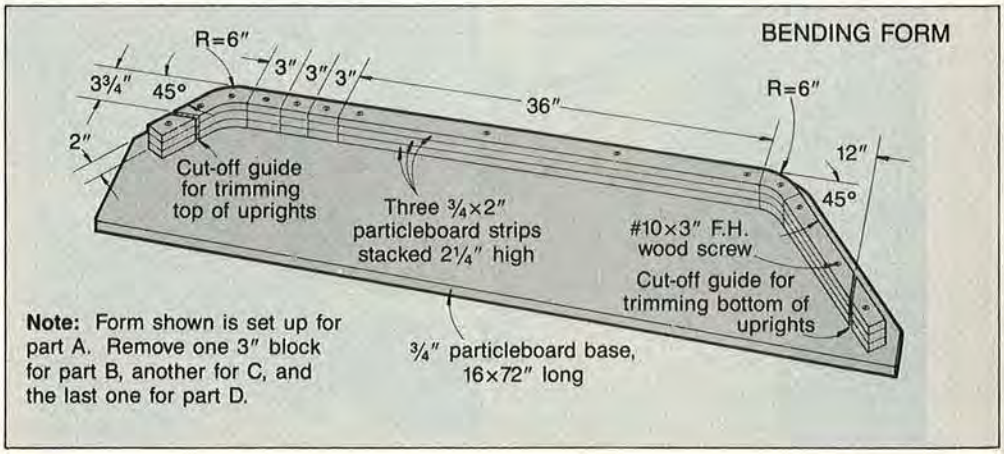
2 Resaw the strips (the stock will be on edge) to ⅛" thick. (You'll end up with more than the required 24 thin strips—six for each upright—but you'll probably break a few when resawing and bending.) Then mark the lengthwise center of each strip.

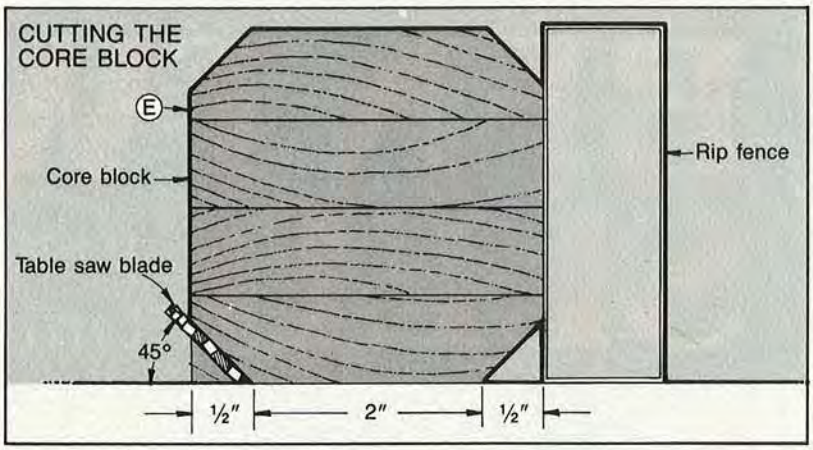
3 Lay waxed paper on the form, then glue and clamp six thin strips to the form to laminate the longest upright (A) as shown in the photo, *below*. Make sure

the center marks on the form and the strips line up. (We poured the glue into a paint tray and applied it to the strips with a narrow paint roller. We also found it handy to have a helper on hand when bending the wood around the curves.)

4 After the glue dries, remove the laminated upright from the form, and get rid of the waxed paper clinging to the upright. Reclamp the upright to the form,







making sure the top edge of the upright is slightly above the top edge of the form. Use only enough clamps to hold the lamination in place. Scrape the excess glue from the top edge of the lamination, and use a hand plane or a belt sander to smooth the edge. Check the edge periodically with a small combination square to ensure squareness; sand the edge smooth. Flip the lamination over and repeat this process with the other edge, planing the upright down to a 2" finished width.

5 Using a fine-toothed handsaw, trim both ends of the upright using the cut-off guides shown in the Bending-Form Drawing.

6 Remove one of the 3" sections from the form. Then reposition the curved portion of the form so it fits snugly against the center section, and rescrew it to the base. (Save the 3" piece if you plan to reuse the form later.) Now repeat the procedure for upright A to make the second-longest upright (B).

7 Laminate the remaining two uprights (C, D), following the same procedure. Don't forget to remove another 3" section each time.

8 Sand the ends of each upright to round-over the sharp edges as shown in the Exploded-View Drawing. Then, using sandpaper, break the edges and finish-sand all four uprights.

FORMING THE CORE BLOCKS

1 Cut four pieces of ¾" oak 3¼" wide by 10" long. Glue and clamp the pieces together. After the glue dries, scrape off the excess and plane, joint, or rip the lamination to 3 × 3 × 10".

2 Using the drawing, *above*, as a guide, cut the chamfers at each corner of the lamination with a table saw. Crosscut the lamination into two 3'-long blocks (E). Sand both blocks.

ASSEMBLING THE COAT-TREE

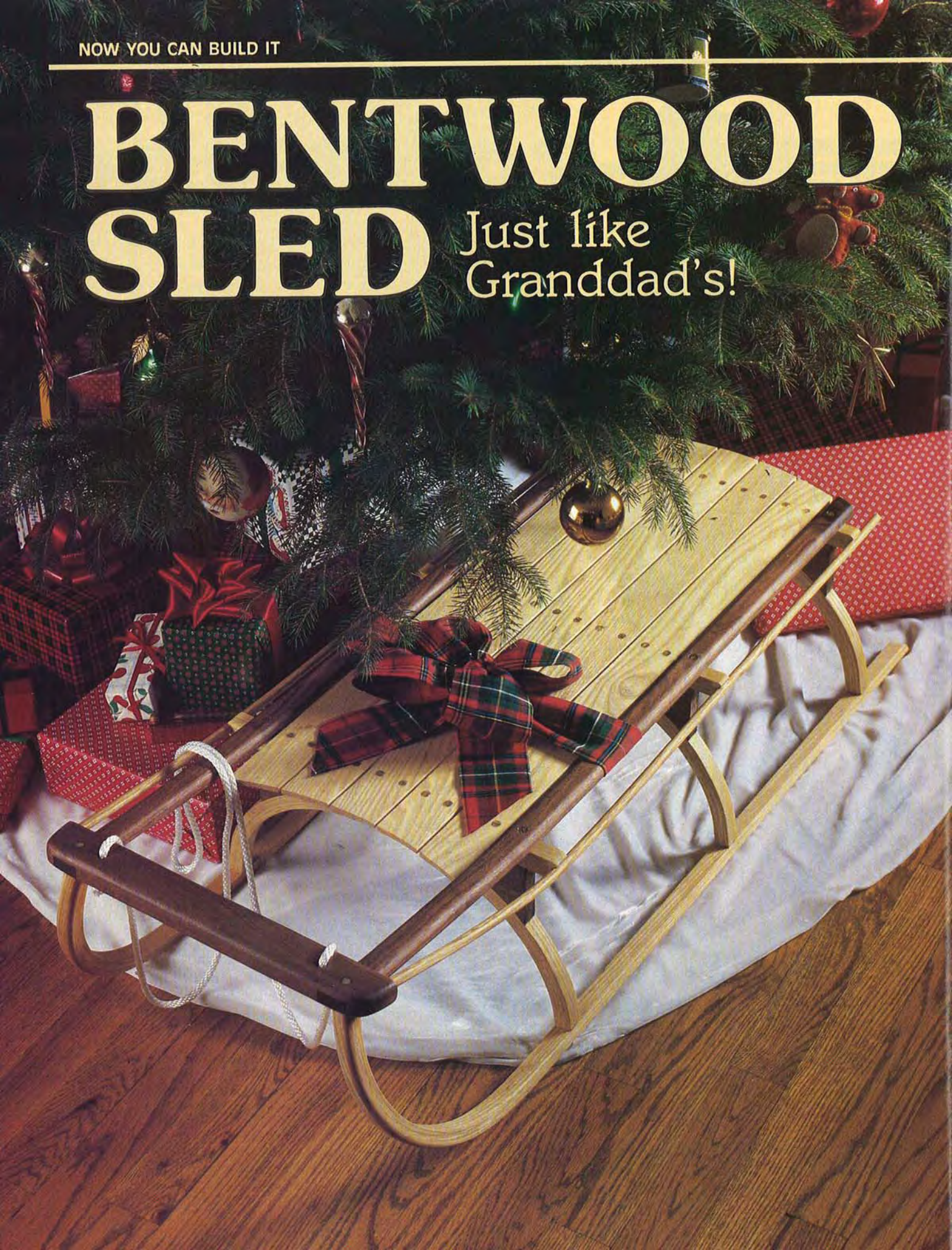
1 Glue and clamp two opposing uprights (A, C) to the core blocks, keeping the bottom of the uprights level. Drill ⅜" holes ¼" deep into the uprights where shown in the Exploded-View Drawing. Then drill a pilot hole through the center of each hole for the #8 × 1½" wood screws. Fasten all four uprights to the core blocks in this manner.

2 Cut ⅜" oak plugs, glue them into the holes over the screws, and sand the plugs flush. Apply the finish. (We used a small foam brush to apply polyurethane. These come in handy when coating the inside of the uprights.) ■

Project Design: James Downing
Photographs: Hopkins Associates
Illustrations: Bill Zaun, Randall Foshee

BENTWOOD SLED

Just like Granddad's!



We think you'll agree that just about anything becomes more special when it's made of wood. Case in point: This walnut and ash adaptation of an old-time sled. Why settle for one of those throwaway plastic jobs when you can build an heirloom that will delight youngsters for generations? The epoxy-laminated runners and supports make this sled amazingly strong and moisture-resistant, yet lightweight enough to whoosh down a hill with the best of 'em. Just ask Granddad . . .

Note: If this is your first attempt at either laminating or using epoxy, refer to the article "How to bend laminated wood" on page 36 and our "Epoxy" article on page 60 of this issue.

FORMING THE RIBS AND RUNNERS

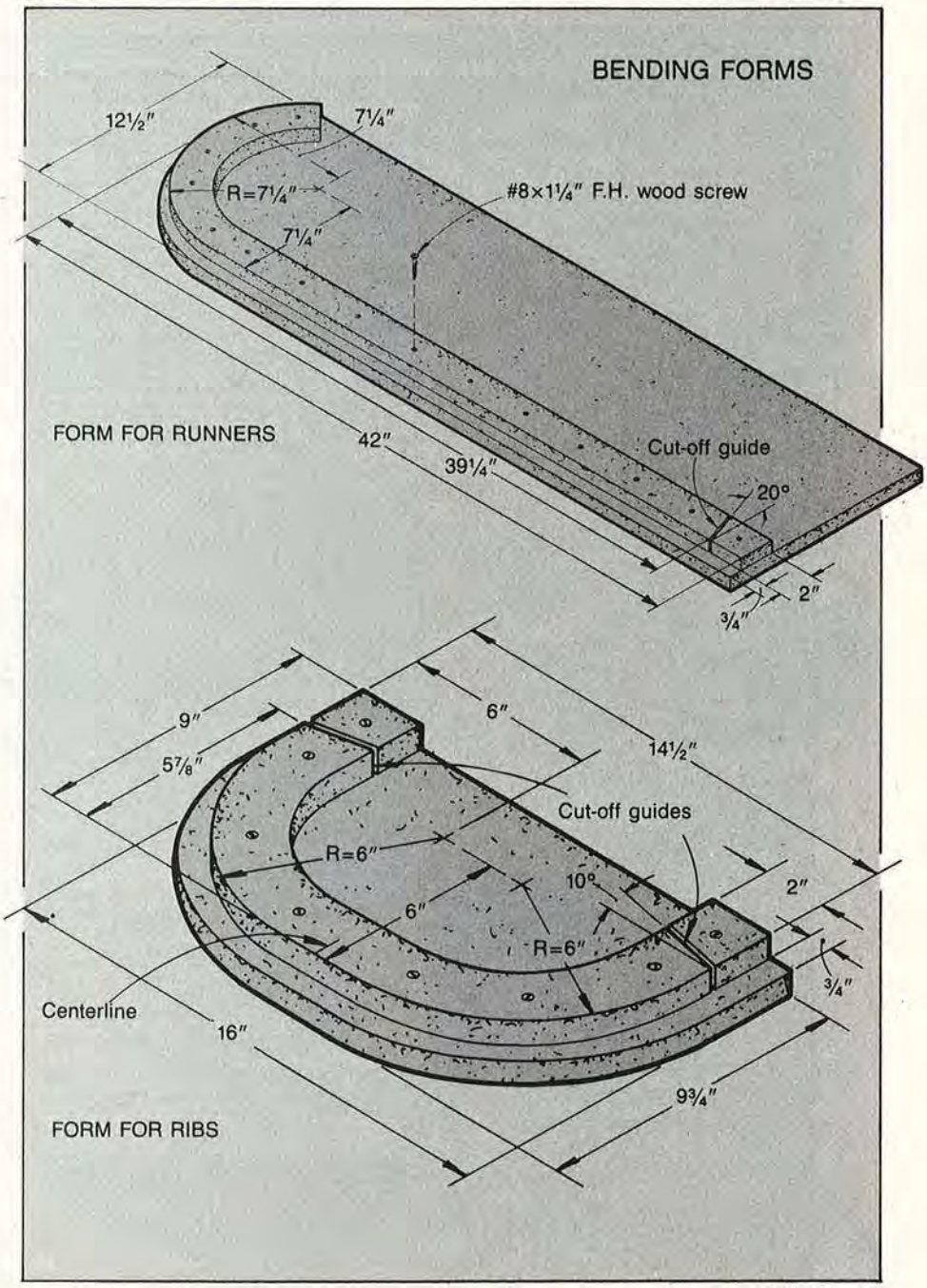
1 Construct the bending forms for the runners (A) and ribs (B) from ¾" particleboard, as dimensioned in the Bending-Form Drawing. (We used a belt sander to smooth and square up the curved pieces before attaching them to the base of the form.)

2 From straight-grained ¾" ash, rip 12 strips ⅛" thick by 60" long for A, and 18 strips ⅛" thick by 36" long for B, as shown in the Cutting Diagram. Pieces are cut long and trimmed to length later.

3 Cover the edges of the forms with waxed paper to prevent the strips from sticking. Then, epoxy six of the 60" strips together and align them on the runner-bending form. Clamp the strips to the straight end of the form first, then work toward the curved end, tightening the clamps uniformly as you go. Allow the epoxy to set up at least 12 hours. Remove the clamps and sand the runner edges smooth. Repeat this procedure to make the other runner.

4 Use a router with a ¼" roundover bit to shape the bottom edges of the runners. (When routing any lamination, move the router very slowly to avoid chip-out.) With a backsaw, cut the tail ends to length, using the cut-off guide on the bending form.

5 To make the first of the three ribs (B), repeat the preceding techniques, but begin clamping toward the *center* of the form and work around to each end.



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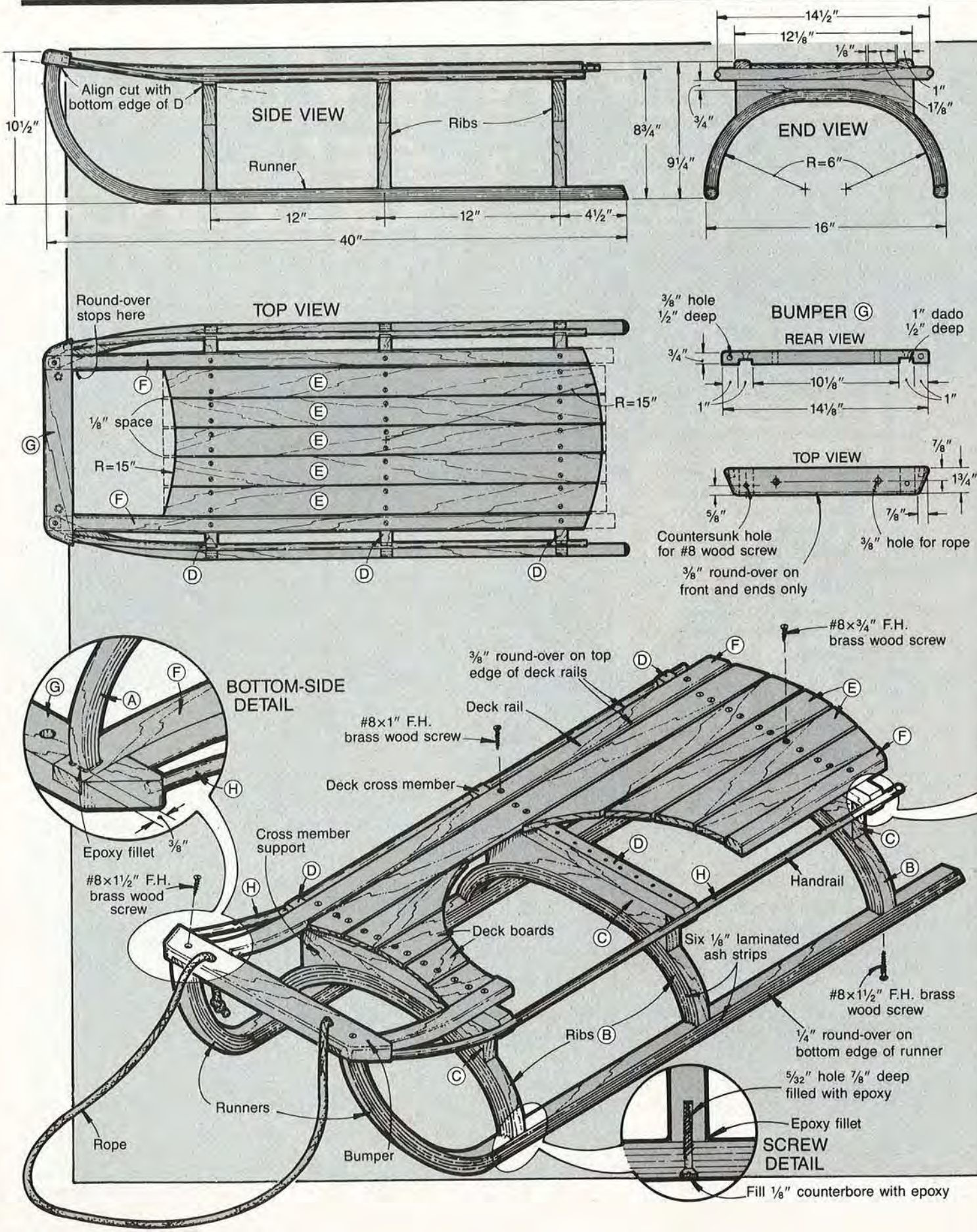
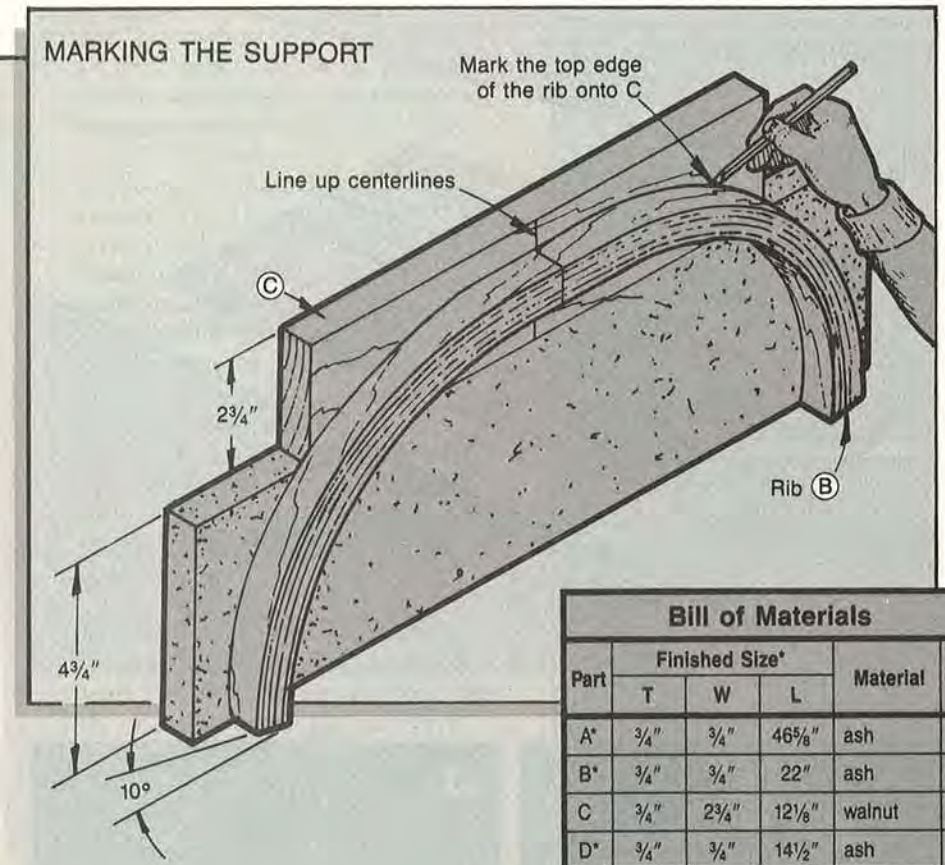
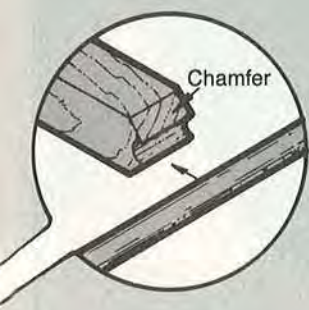

SIDE VIEW
Align cut with bottom edge of D
Ribs
Runner
10½"
8¾"
9¼"
12"
12"
4½"
40"
END VIEW
14½"
12⅛"
⅛"
1"
1⅞"
¾"
R=6"
16"
TOP VIEW
Round-over stops here
⅛" space
R=15"
R=15"
BUMPER Ⓖ
⅜" hole ½" deep
1" dado ½" deep
REAR VIEW
¾"
10⅛"
14⅛"
1"
1"
TOP VIEW
⅞"
1¾"
⅝"
⅞"
Countersunk hole for #8 wood screw
⅜" hole for rope
⅜" round-over on front and ends only
BOTTOM-SIDE DETAIL
Epoxy fillet
⅜"
#8×1½" F.H. brass wood screw
Cross member support
#8×1" F.H. brass wood screw
Deck rail
Deck cross member
⅜" round-over on top edge of deck rails
#8×¾" F.H. brass wood screw
Handrail
Deck boards
Six ⅛" laminated ash strips
#8×1½" F.H. brass wood screw
¼" round-over on bottom edge of runner
Ribs Ⓑ
Runners
Rope
Bumper
⅝₂" hole ⅞" deep filled with epoxy
Epoxy fillet
SCREW DETAIL
Fill ⅛" counterbore with epoxy





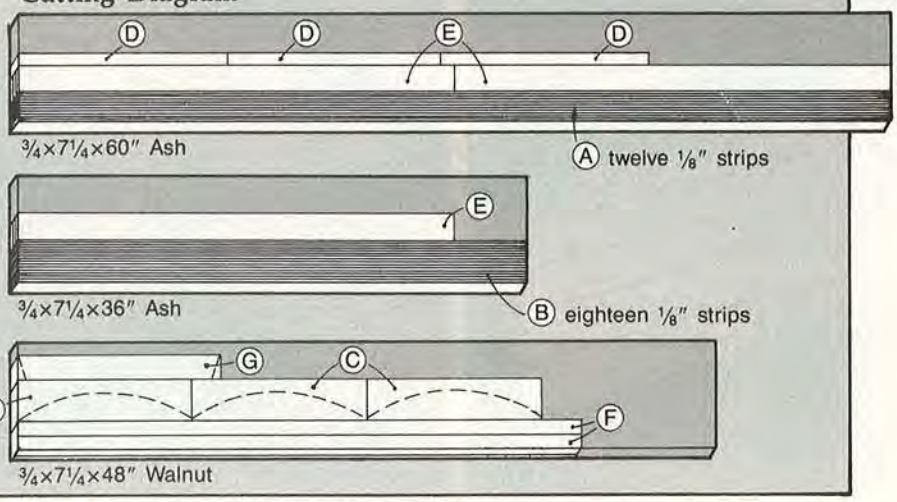
Bill of Materials

Part	Finished Size* T	W	L	Material	Qty.
A*	¾"	¾"	46⅝"	ash	2
B*	¾"	¾"	22"	ash	3
C	¾"	2¾"	12⅛"	walnut	3
D*	¾"	¾"	14½"	ash	3
E*	¼"	1⅞"	29"	ash	5
F*	½"	1"	36¾"	walnut	2
G	¾"	1¾"	14⅛"	walnut	1
H	⅜" diam.		36"	oak dowel	2

*Some parts are cut larger initially, then trimmed to finished size. Please read the instructions before cutting.

Supplies: #8×¾" flathead brass wood screws, #8×1" flathead brass wood screws, #8×1¼" flathead wood screws, #8×1½" flathead brass wood screws, epoxy, colodial silica, 6' of ¼" braided nylon rope, exterior polyurethane

Cutting Diagram



6 Sand the edges of the rib smooth, remount it on the rib-bending form, and mark the centerline. Using the cut-off guides shown in the Bending-Form Drawing, trim both ends of the ribs. Repeat this process to make the other two ribs.

7 Rip the three ¾" walnut support members (C) to 2¾" and crosscut them to 12⅛". Mark the lengthwise center of each. From ¾" particleboard scrap, cut a piece 4¾" wide by 18" long. Stand it on edge next to one of the ribs and position C on the top edge of the particleboard so that the centerlines of B and C align. Mark the top edge of B onto C as shown in the drawing, *left*. Use a band saw or jigsaw to cut the bottom edge of C to shape, then sand it to fit smoothly onto the rib. Repeat this to fashion the other two supports.

8 Cut a piece of ¾" thick ash ¾" wide by 48" long, then crosscut it into three segments 15½" long for the deck cross members (D). With a ⅜" bit, drill a hole on center of the edge, ½" in from each end of each D. Bevel-cut the ends at 45°, bisecting the holes just drilled to obtain a cove as depicted in the Handrail Detail.

9 Mark the lengthwise center of each deck cross member. Epoxy and clamp together one of the B's, C's, and D's, using the marked centerlines to align all three parts of the rib assembly. After the epoxy dries, remove the clamps and sand the assembly smooth. Repeat this for the other two rib assemblies.

ASSEMBLING THE DECK

1 From ¾" ash, cut three pieces 1⅞" wide by 30" long. Set up your table-saw rip fence to resaw the boards to a thickness of 5/16" to yield the deck boards (E). (Use a feather board and push stick for safety.)

2 Lay the deck boards flat on a work surface with one end of each butted up against another thin

Continued

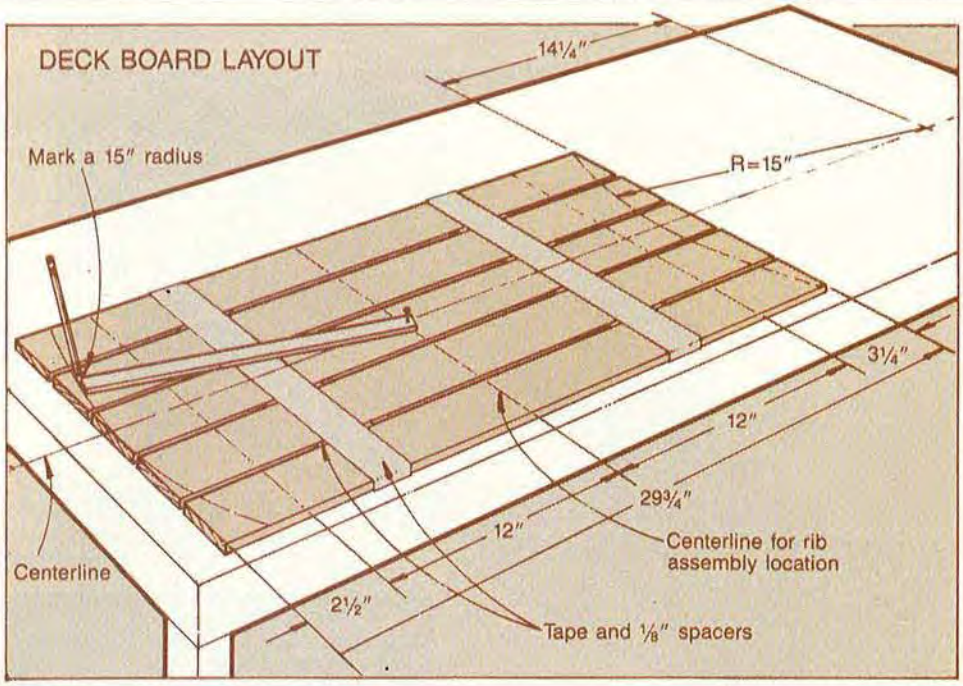
board to hold the pieces in position when machining. Then belt-sand or plane both sides smooth and to a uniform thickness of ¼".

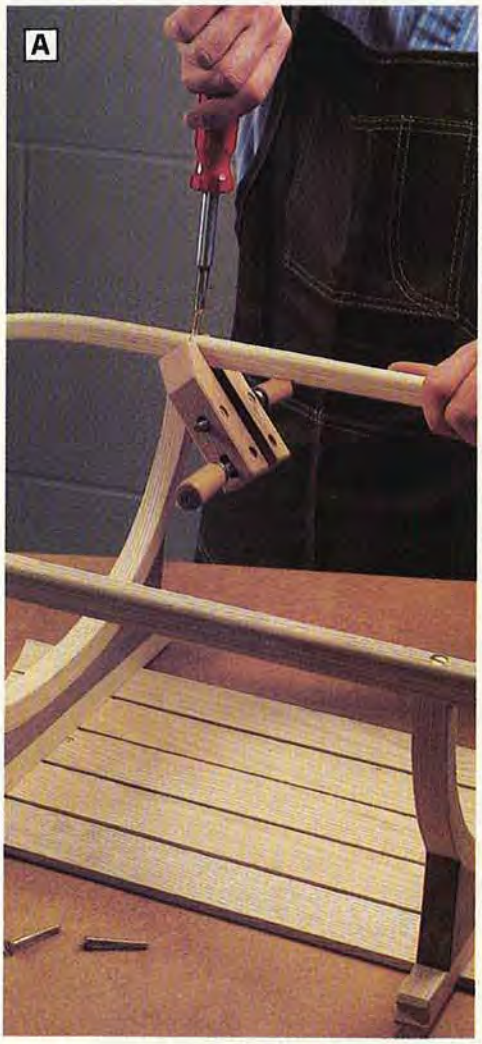
3 Lay ⅛"-wide hardboard spacers between the deck boards for even spacing. Then securely tape the deck boards and spacers together and mark a 15" radius on each end of the deck boards as shown in the drawing at *right*. Mark the centerline of each rib assembly across the top of the deck boards for later mounting to the rib assemblies. With the deck boards still taped together, cut the marked curves and sand the edges smooth.

4 Position and clamp the taped deck board assembly on the three rib assemblies as dimensioned in the Top-View Drawing, checking that the deck boards are square with each rib assembly. Then drill and countersink two pilot holes through each deck board and into the cross members on the marked centerlines. (We used a countersink screw bit for a #8 wood screw to drill the pilot holes.) Apply epoxy to the joints and screw threads, then attach the deck boards and remove the tape and spacers.

ATTACHING THE RUNNERS

1 To locate the runners on the sled assembly, mark the rib centerlines on the runners where indicated in the Side-View Drawing. Counterbore a pilot hole, centered on each mark, through the bottom of the runner as shown in the Screw Detail. Clamp the runners in place on the bottom of the ribs as pictured in photo A, *right*. Using the pilot holes in the runners as guides, drill 5/32" pilot holes into the ends of the ribs. Epoxy the joints and screws into place, leaving a fillet of epoxy at each joint (also shown in the Screw Detail). (We added silica when mixing the epoxy to thicken the epoxy and prevent it from running. Silica also gives the epoxy greater strength and gap-filling capability. Mix the epoxy and silica together to the consistency of peanut butter before applying.





See Information Sources at the end of the "Epoxy" article on page 60 for the addresses of manufacturers of epoxy and silica.)

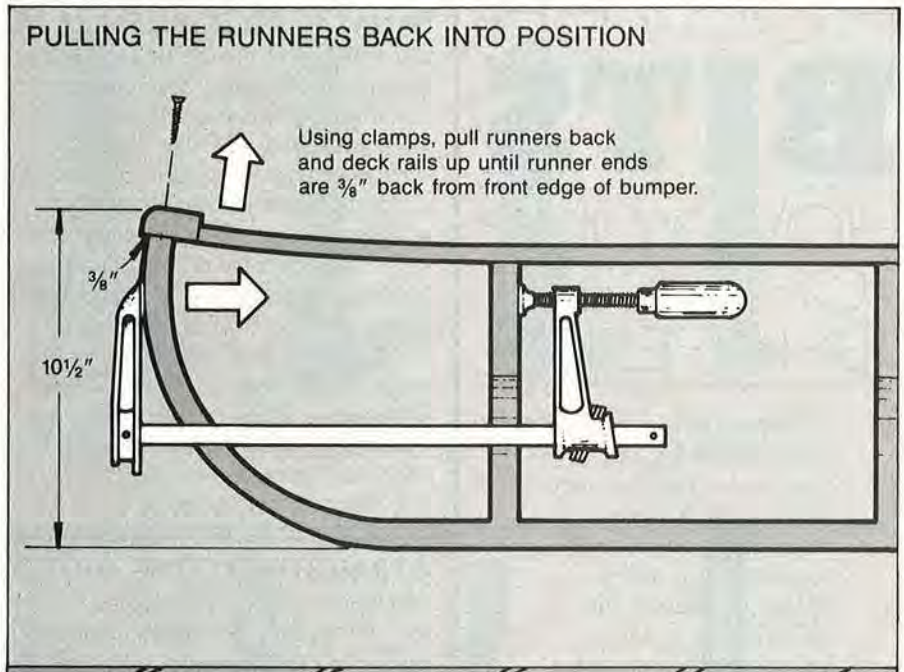
2 Clamp the forward ends of the runners to a 16" wide by 9¾" high scrap board as shown in photo B, *below left*. Using the top of the scrap board as a guide, cut the runner, aligning the saw blade with the bottom edge of the foremost deck cross member (D) as shown in the Side-View Drawing. [The cut doesn't have to be absolutely perfect. The epoxy-silica mixture will fill the joint when you attach and epoxy the front bumper (G) to the runners later.]

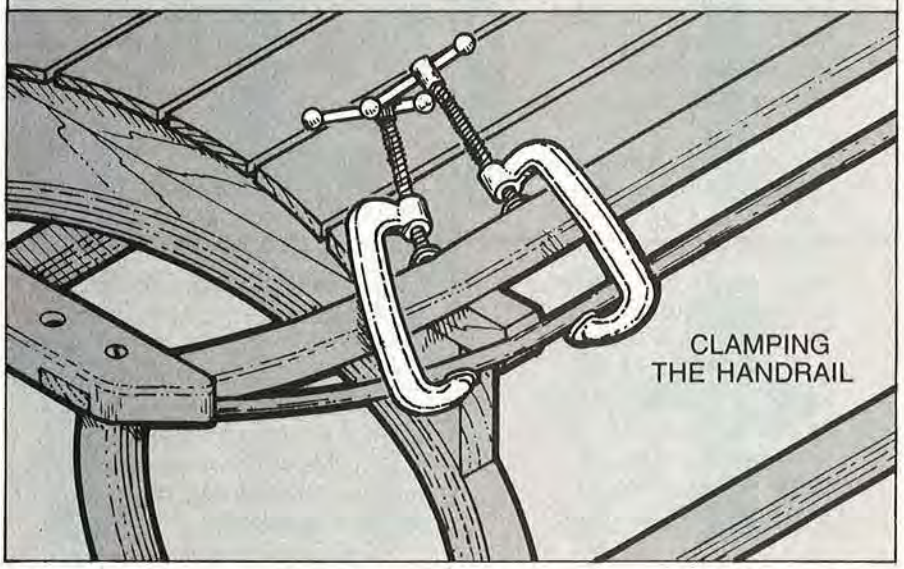
FINAL CONSTRUCTION

1 Cut two pieces of ¾" walnut 1" wide by 40" long for the deck rails (F). Plane or resaw the rails to ½". (To form the rails, we started with ¾" stock and planed it down to ½" thickness on our jointer. We used two push blocks to move the narrow stock safely over the spinning jointer blades.) Then, using a router with a ⅜" round-over bit, shape the top edges of each rail, stopping 2¼" from the front ends.

2 Cut the front bumper (G) to shape as indicated in the Bumper Drawing. Using a router and a ⅜" round-over bit, rout the top-front edge and ends of the bumper. Now cut 1" dadoes ½" deep to accept the deck rails (F), and drill the holes for the handrails (H) and tow rope, as shown in the Bumper Drawing. Epoxy the front bumper to the deck rails, checking for square.

3 Lay the deck rail-bumper assembly (F–G) on the sled frame. Using clamps as shown in the drawing, *above right*, pull the runners back so that the bumper overhangs the front of the runners by ⅜" (also shown in the Bottom-Side Detail). Now, mark the location of the cross members (D) on the rails (F). Drill and countersink pilot holes through the rails and into the cross members. Epoxy and screw the deck rails into place.


PULLING THE RUNNERS BACK INTO POSITION
Using clamps, pull runners back and deck rails up until runner ends are ⅜" back from front edge of bumper.
⅜"
10½"



4 Drill and countersink pilot holes through the bumper-rail assembly and a 5/32" pilot hole into the ends of the runners. Epoxy the joints and screws into place, again leaving a fillet of epoxy around the joint.

5 Trim the tail end of the rails to match the 15" radius on the tail end of the deck boards.

6 Epoxy the handrails (H) into the ⅜" holes in the front bumper (G), then clamp and epoxy them into the coved ends of the cross members (D) as shown in the Handrail Detail. (We used two small clamps, one on each side of each cross member, to pull the handrails into alignment as shown in Clamping the Handrail Drawing, *above*. The handrails have a tendency to spring out of alignment unless clamped this way.)

FINISHING THE SLED

1 Finish-sand the entire sled and apply several coats of exterior polyurethane. Attach the rope. Periodic applications of paste wax will further protect the sled from moisture and keep the runners slick. ■

Produced by: Marlen Kemmet
Project Design: Kim Downing
Photographs: Hopkins Associates, Bob Calmer
Illustrations: Bill Zaun, Randall Fosbee

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ROUTER BITS

HOW YOUR CHOICES SHAPE UP

It happens before you know it—bit by bit, your router bit inventory builds until it's worth more than your router! A good, basic understanding of router bits and what they do can help you save some of that hard-earned cash and still get the most mileage from your router.

With several hundred options, including prices from $5 to $50, facing you when you want to buy a router bit, it helps to narrow your choices. To do that, you have to know the types of bits and what they're intended to do. Starting with what bits are made of, we've organized the selection on these pages.

Written with Roger W. Cliffe,
Associate Professor, Industrial Technology,
Northern Illinois University
Illustrations: Greg Roberts

WHAT ROUTER BITS ARE MADE OF

Stamped steel yields the least expensive router bits. Stamped into bit shape, rolled to configuration, then hardened, the flat steel used isn't meant for long-term routing or a depth of cut greater than ⅛" (it may bend). At about half the cost of a high-speed steel bit, it isn't practical to sharpen a stamped bit unless you do it yourself.

Climbing the price ladder to the under $10 range, you'll find *high speed steel* (HSS) on the next rung. HSS bits, machined from solid-bar stock and ground to exact size, take the sharpest cutting edge of all bits. However, they dull quickly in very hard wood and composition materials. Dennis Huntsman of Porter-Cable suggests honing the flat side of a HSS bit with a sharpening stone for extra mileage.

Add an edge of tungsten carbide to HSS, double the price, and you have the even more expensive *carbide-tipped* router bit. Carbide-tipped bits stay sharper about 20 times longer than HSS or stamped steel. And they'll easily shear most woodworking materials except metal, which can cause them to fracture. A tiny fracture, advises

STRAIGHT-CUTTING OPTIONS

Straight bits cut a rectangular groove in the workpiece, plane an edge, or make a rabbet. In most applications they require a fence or other control device to guide their cut.

These bits have either one or two flutes, which provide wood-chip clearance. *Single-flute* bits, although actually making only half the number of cuts per revolution that *double-flute* bits do, cut faster because they have plenty of chip clearance.

Stagger-tooth straight bits, a two-flute type, have one cutter extending down from the top to slightly past center and the other coming up from the bottom the same distance. A stagger-tooth bit cuts as

EDGE-FORMING CHOICES

Edge-forming bits cut on the edge of the work with the help of a pilot that controls their straight or irregular path. The pilot may be either integral or removable ball bearing. Bits in this category include rabbeting, cove, roundover, beading, camfer, and classical.

Solid-pilot or single-piece tips usually measure a ¼" or less in diameter, and because they rub on the edge of the work at the same r.p.m. as the router, they can heat up and burn the wood. *Ball-bearing* pilot tips, on the other hand, roll along the edge at a slower rate than the revolution of the bit. Because they turn only at feed rate, ball-bearing pilot tips won't burn your work unless the bearing jams due to accumulation of dirt or debris. Porter-Cable's Huntsman

GROOVE-CUTTING SELECTIONS

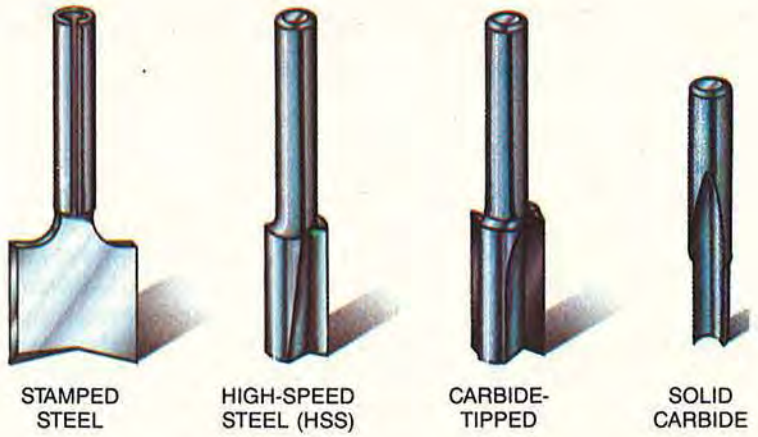
Requiring a guide or fence to direct their path, groove-forming bits are designed to cut a channel in the face of a workpiece, such as in sign-making. They are very similar to edge-cutting bits except in that they have no pilot tip. In fact, groove-cutting bits may be used with a fence to rout an edge. Among the many choices in this group you'll find these often-used bits: round-nose (core box), ogee, classical, beading, dovetail, and veining.

SPECIAL PURPOSE ALTERNATES

Special purpose bits actually fall into one or the other of the functional categories, but they deserve special notice because they fill highly specialized needs. Among the bits in this group are piloted and ball bearing groove-forming cutters called slotting bits, edge-forming bits such as the flush trimmer for plastic laminates, and molding-type bits such as the raised panel cutter. Many of these make repetitious production work easier.

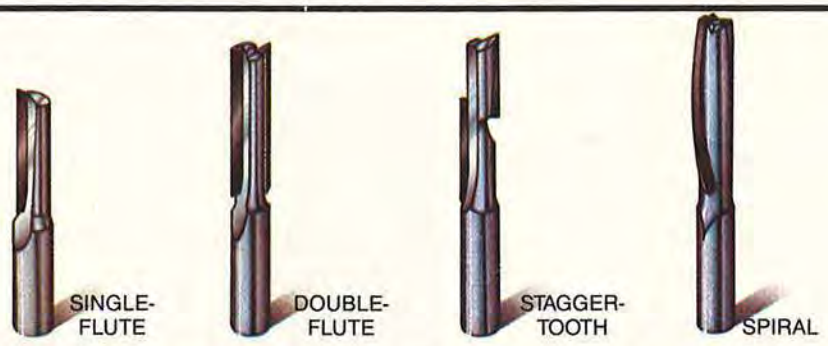
the Robert Bosch Company's Don Duffy, makes investing in a new bit more sensible than resharpening. He notes that industrial-quality, carbide-tipped bits may be resharpened up to six times if they show no sign of chips or fracture. But remember that each time a bit has to be resharpened, its diameter will be reduced slightly.

Manufactured in short lengths (under 1"), *solid-carbide* bits are used primarily for trimming laminates. The short length helps prevent bit deflection and fracture.



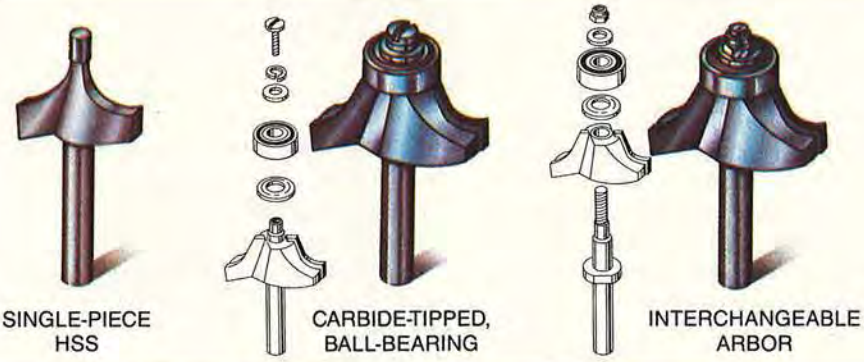
fast as a single flute, but leaves a smoother cut.

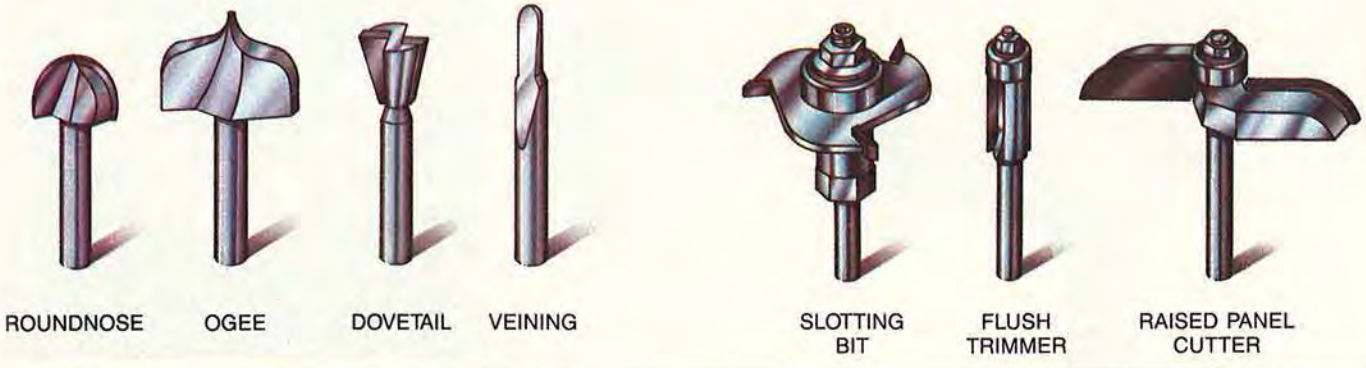
Another type of two-flute straight bit, the *spiral*, resembles a twist-drill bit, a feature that DML's Fred Garms says reduces chip accumulation and heat buildup. Due to its shearing action, the quality of the cut improves, but it cuts slower than other two-flute bits.



suggests buying an extra ball bearing when you purchase the bit so you won't have to interrupt a project in case a bearing fails. These bits come in diameters of ⅜" and larger.

Interchangeable-arbor or *assembled* bits also can fall into the edge-forming classification, although the cutter may be refitted and the pilot tip removed for groove-forming.





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READERS, IT'S YOUR TURN! PROJECT

A. PARQUET ON DISPLAY

Yep, woodworkers, that's oak parquet flooring you see on this coffee table—and it couldn't look nicer! *Walt Logel of Springfield, Missouri,* made optimum use of simple lines to highlight the parquet top.

Continuing the top's golden hue into the table's framework, Walt fashioned the sides and legs from oak. He used 1×3s for sides and 2½" squares for the legs, joining them with glue and dowels. The parquet was laid onto ½" particleboard with mastic. Measuring 38½×38½×16", the table has a polyurethane finish.

Walt keeps this table in his living room, but he also enjoys building furniture for family and friends. With work like this, we'll bet Walt has more friends than time.

B. COMPUTER/DRESSER COMBO

When your youngster adds a computer to his already jammed bedroom, what do you do? Pack his clothes under the bed? *Bud LaFever of Omaha, Nebraska,* considered the situation a design challenge: how to combine a computer and study area, plus clothing storage, in the space of a 42"-wide dresser. This photograph displays his ingenious solution.

Bud made the cabinet of ¾" lumber-core ash plywood and solid ash facing and trim. For the drawer sides, cabinet back, and top, he used fir plywood. Bud incorporated a computer compartment with a door that folds flat for a work surface and a "muffin" fan in the back panel to ventilate the computer and screen. Three drawers and two large cabinet spaces on top accommodate clothes.

The computer and storage center, finished with a dark walnut Minwax and polyurethane, stands 74" high, 42" wide, and 22" deep. "It took three weekends to complete," Bud says, "and fills a specific need like nothing available commercially."

B

C. WALNUT AND HOLLY NECKLACE

A member of the International Wood Collectors' Society, *Menalkas "Mac" Selander of Portland, Oregon,* puts much of his wood into jewelry. The retired commercial artist sells pieces, like the walnut and holly example shown at local craft fairs.

Mac is an apartment dweller, so his work area has to take up as little space as possible. He uses only hand tools to make and assemble the neckpieces once he's band-sawed

C

A

SHOWCASE

the stock to ⅛" thickness. Mac cuts out the wooden "petals" with a jeweler's saw and bores out the strand pieces with a No. 55 handdrill bit. For a nongloss finish, he likes a first coat of Watco teak oil, then a second blended of Minwax Antique Oil and tung oil.

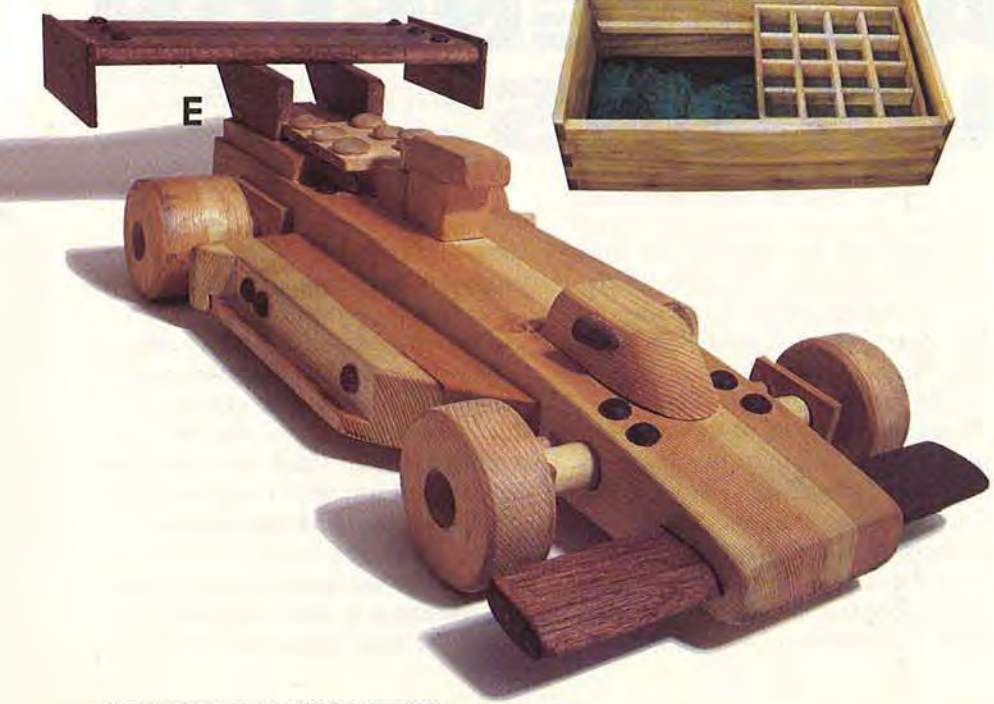
D. QUEEN-SIZE JEWELRY BOX

Woodworker *Rob Grant of Alexandria, Virginia,* creates custom wooden gifts on a part-time basis in his home shop. All his work, like this jewelry box the size of a silverware chest, displays a contemporary flair, Rob tells us.

The box measures 21×11×6" and has two removable trays with individual compartments (32 in all) and a lower storage area lined in black velvet. Rob didn't divulge who he made it for, but the box's capacity indicates an oil heiress!

The case features dovetail joints, while end-lap joints form the lid. Except for the lid's cherry panel, the box features walnut, handrubbed with oil, then topped with wax (the flush-fitting lid has no hardware, but lifts completely off).

Rob's finely crafted work didn't just "happen." Over the years he has earned a degree in industrial arts, taught an adult woodworking class, and been a member of the Washington Woodworkers Guild.



E. FIRST TIME, FIRST PLACE RACER

Eighteen-year-old *Sean Murphy of Des Moines, Iowa,* spent little time working with wood before he built this aerodynamic racer. Then, as a first-year student at the Kansas City Art Institute, his curriculum included an intensified woodshop course that familiarized him with tools and materials through designing and producing a project.

"I always admired fast, sleek cars," he says, "and some long, thin pieces of scrap looked about right." The 24" pine pieces, cut and glued up, became his speedster's body. From there, scrap pieces of walnut, birch, and oak were transformed into the engine, wheels, airfoil, and cockpit. In fulfilling the course requirement, Sean used practically every tool in the shop. Although he neglected to tell us what grade he received, to us, his race car rates first place.

To submit your projects . . .
Send a 35-mm color slide, with the project as the focal point and a simple background—no people. Include a capsule description—materials, special joinery, finish, and dimensions, for example. *WOOD* will pay $25 for published projects. Slides cannot be returned unless you enclose a self-addressed, stamped envelope.

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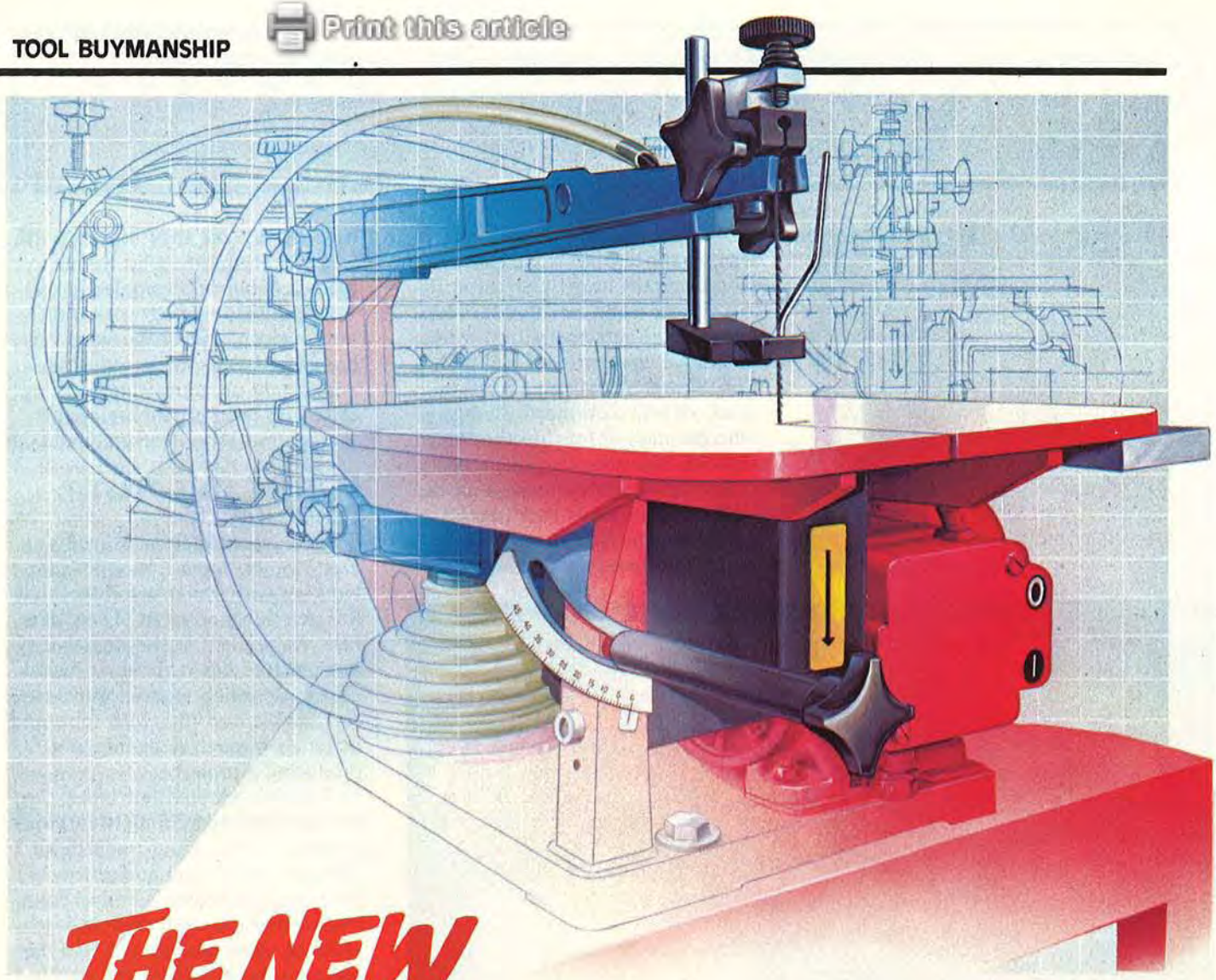


THE NEW CONSTANT-TENSION SCROLL SAWS

Great in a tight spot!

For most of us, the only exposure to scroll saws was an old-style, rigid-arm machine back in high school shop. We were not impressed. The rigid-arm design with its push/pull cutting action (see drawing, *opposite page*) did not change appreciably in 50 years. Although most of these saws were well built, they simply did not cut with enough speed or accuracy.

Then, in 1978, everything began to change. Hegner introduced its "constant-tension" parallel-arm saws with pull/pull cutting action to the American market. The superior design of the Multimax-2 and the Polymax-3 renewed interest in scroll saws, both here and abroad.

Although they are based on an American patent for the "walking-beam" scroll saw from the 1870s (still manufactured by The Tool Company in motor- and pedal-powered kits), the Hegner models were the first in several decades to utilize the concept of pull/pull, constant blade tension. The Hegner saws also reflected many design innovations that improved blade life and cutting characteristics.

Now it seems that Hegner and AMI (the sole U.S. importer) have convinced just about everyone (including competitors) that its constant-tension scrolling system can indeed perform with excellent results, even in materials up to 2" thick. From one brand and two models ten years ago, the selection has increased to eight manufacturers and 17 machines by 1985.

WHAT A SCROLL SAW CAN DO FOR YOU

For any kind of toy, puzzle, jewelry, or inside or outside fretwork (from veneers up to 2" materials), no tool can outdo the scroll saw. It is much safer than a band saw (or any other power saw), and you can spin corners as tight as the width of the blade.

Sure, a band saw is great for scrolling wider turns. And a handheld jigsaw can make cuts in panels much too large for either type of stationary scrolling machine. But only the scroll saw gives you the fine detailing and intricate pattern-cutting capability made possible by the fine blades that this saw drives.

Other advantages are apparent, too. The modern scroll saw is a fairly small machine that can fit easily in an apartment or small home where other power tools cannot. You can learn to use the constant-tension scroll saw quickly. And it's one of the quietest of power tools, with little vibration and dust.

CONSTANT-TENSION VS. RIGID-ARM DESIGN

The old way: Drawbacks, with one advantage

With the original scroll saw, or jigsaw, design, the blade attaches to a drive piston under the table; the upper end attaches to a second piston tensioned with a spring. As the drive piston pulls the blade down in the cutting stroke, the upper piston spring compresses to provide force to pull the rather flimsy scrolling blade back up through the workpiece.

This push/pull blade drive and other features—such as fixed-blade locks, blade guides, and a simple up/down stroke—cause rapid blade failure with the resulting downtime, poor cutting and lots of cut marks. Further, such saws can handle only stock up to ¾" with any finesse (hardwoods are a heartache).

However, this system has one distinct advantage over the new version: Most of these saws are designed with a removable upper arm. This feature permits the use of files and small sanding blocks in the drive piston for fine perpendicular sanding of scrollwork.

The new constant-tension saw: No more "blade crash" and lots less sanding

Today's constant-tension scroll saws come in two basic types: the *parallel arm* and the *one-piece C-arm.* Although each type has a slightly different forward and back movement during the cutting stroke (most tools have a stroke length of ¾" to 1"), their blades move in approximately the same manner.

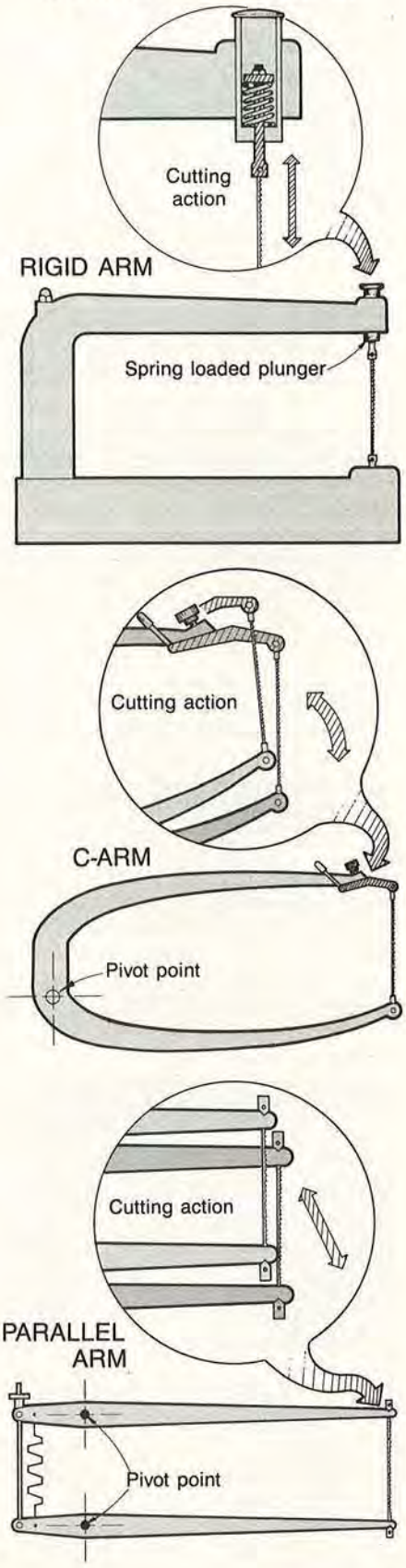
The blade is held between the forward ends of the arms at a constant tension (about a "middle C" when plucked). In parallel-arm saws, this tautness comes from tightening a tensioning rod at the rear of the machine; in C-arm saws, you use a lever or knob mounted at the front of the upper arm.

Through an offset cam linkage between the motor and the lower arm, the two arms alternately pull the blade back and forth through the workpiece. The pull/pull action saves you from "blade crash," common in rigid-arm saws. This happens when the blade jams into the wood and the upper arm spring cannot pull the blade through. The motor then crushes the blade into the bottom of the work.

Due to the front/back horizontal as well as vertical motion of the constant-tension saw, the blade "rasps" on the sidewalls of the cut. This eliminates almost all of the teeth marks that rigid-arm saws and band saws leave behind. In some cutting situations, depending on the feed rate and the material type, a constant-tension saw can eliminate 90 percent of sanding time.

Of course, you can cut faster on a band saw than on a scroller. But even with a thin blade (⅛"), a band saw *cannot* turn as sharply as the scroller. And the sanding time to eliminate band-saw teeth marks outweighs the cutting time lost on a scroll-saw (sanding isn't nearly as much fun as cutting anyway). Also, blade-change time is much less with a scroll saw.

SCROLL-SAW STYLES



Continued

SCROLL SAW COMPARISON CHART

														MOTOR				B'RINGS.		OPTIONS			
Manufacturer	Model No.	Arm Style	Throat Depth (in.)	Stroke Length (in.)	Strokes per Minute	Max. Cut. Depth (in.)	Table Size (in.)	(L)eft (R)ight Table Bevel	Machine Weight (lbs.)	Blade-Lock Style	Blade Guard (Y/N)	Speed Control	Drive System	Type	Amps	Motor	Arm Pivots	Tie Rod to Motor	Light (Y/N)	Blower(Y/N)	Stand (Y/N)	Price
AMT	4390	P	15	3/4	1725	2	8×17	L45°	42	S	N	N	D	I	2.5	S	S	B	N	N	N	$ 200
Delta	40-601	C	18	7/8	40-2000	2	16" diam.	L30° R45° U15° D30°	132 w/s	A	Y	E	D	DC	1.7	B	B	B/R	Opt.	Y	Y	$1074
Hegner	Hobbymax	C	14	1/3	1660	3/4	6½×12	L45°	18	S	N	N	D	I/TEFC	0.9	B	SS	S	Opt.	Opt.	Opt.	$445■
Hegner	Multimax-2	P	14⅓	13/16	1660	2	7×15	L45°	28	S	Y	N*	D	I/TEFC	1.9	B	S	B	Opt.	Y	Y	$894■
Hegner	Multimax-3	P	25	3/8 or 13/16	1200	2	10×20½	L45°	66	S	Y	N*	D	I/TEFC	2.0	B	S	B	Opt.	Y	Y	$1559■
Hegner	Polymax-3	P	19¾	9/16 or 1	700/1100/ 1270/1600	2	10×19	L45°	85	S	Y	B	B	I/TEFC	3.6	B	S	B	Opt.	Y	Y	$1959■
Humfrey	Excalibur II	D	19¼	3/4	400/800/ 1400	2	12×17¼	L/R45°	50 l/mtr.	F	Y	B	B	Optional		B	B/S	B	Opt.	Y	N	$495■ l/mtr.
Humfrey	Excalibur 24	P	24¼	3/4	600-1800	2	14×24	L45° R20°	110	A	Y	E	D	DC	2.4	B	B	B	Opt.	Y	Y	$1285■
RBI	Hawk 12	P	12	5/8	1725	2	11×16	Fixed	48	S & A	N	N	D	I/TEFC	1.8	B	S	B	Opt.	Opt.	N	$ 349
RBI	Hawk 14	P	14	13/16	1720	2	10½×21	L/R45°	73	S & A	N	N	D	I/TEFC	1.8	B	S	B	Opt.	Opt.	Y	$ 499
RBI	Hawk 20	P	20	1⅛	695/1110	2	14¼×25	L/R45°	97	S & A	N	B	B	I/TEFC	1.8	B	S	B	Opt.	Opt.	Y	$ 699
RBI	Hawk 26	P	26	1 1/16	500-1650	2½	14¼×24	L/R45°	138	S & A	N	E	D	DC	1.8	B	S	B	Opt.	Opt.	Y	$1299
RBI	Eagle	C	16	1⅛	695/1110	2	14¼×25	L20° R45°	77	S	N	B	B	I/TEFC	1.8	B	B	B	Opt.	Opt.	Y	$ 849
Sears	2076	P	18	7/8	1700	2	9×14⅜	L/R45°	26	S	Y	N	D	I	2	B	B	B	N	Y	Opt.	$ 250
Tool Company	Velocipede 2	W/B	24	1⅛	Var.	2	20×32½	Fixed	50	A	N	Pedal drive						D	N	N	Y	$ 600
Tool Company	Kit saw #3+	W/B	24	1⅛ or 5/8	800	2	20½×31½	Fixed	10++	A	N	Optional						D	N	N	Opt.	$ 160
Woodmaster	1600	P	16	15/16	1725	2	9¾×15⅝	L/R45°	70	S	Y	N	D	I	1.8	B	S	B/S	Opt.	Opt.	Y	$ 649

Arm Style
P=Parallel
D=Double parallel link
C=C-arm
W/B=Walking beam

Bearings
SS=Spring steel plate
B=Ball
S=Bronze sleeve
D=Delvin sleeve
R=Roller

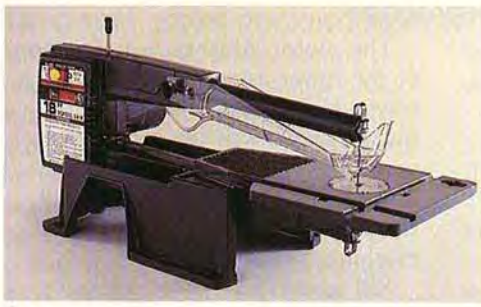
Blade-Lock Style
S=Separate pivoting clamp
A=Attached pivoting clamp
F=Fixed clamp

Motor Type
I=Induction
DC=Permanent magnet DC, totally enclosed
TEFC=Totally enclosed, Fan cooled

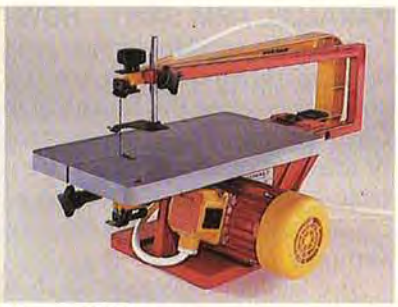
Speed Control
E=Electronic
B=Belt
N=No

Drive System
D=Direct
B=Belt

* Electronic speed control optional
■ Prices include shipping and handling
\+ Also available as kits #1, 2, 4
#1 Includes stand, table, motor—$375
#2 Includes stand, table—$300
#4 Includes stand, table, no arms—$130
++ Weight of kit parts only

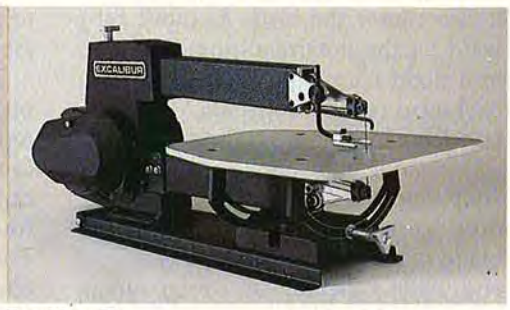


Sears



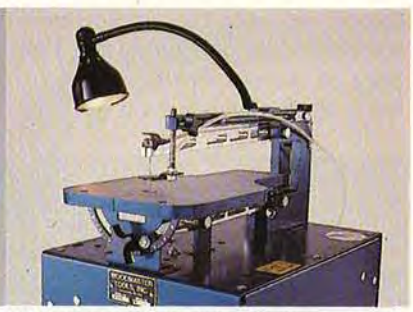
Hegner Hobbymax

AMT



Excalibur II

Hegner Multimax 2



Woodmaster with optional lamp

Delta Electronic

RBI Hawk 14

RBI Eagle

Excalibur 24

GRIPPING THE BLADE WITH PIVOTING CLAMPS

One of the main reasons for blade failure in rigid-arm scroll saws is the fixed-blade clamps: The thin scroll-saw blade tends to bow back as you push it through a piece of wood. With the ends of the blade solidly locked in immovable clamps, the blade cannot flex without bending at the clamp, causing metal fatigue and breakage.

In all but one of the "new breed" of scrollers, the blade attaches to the moving arms with pivoting blade clamps. These clamps are either pinned to the ends of the arms (as in the Delta, Excalibur 24, RBI Hawk, and The Tool Company models) or they are separate, attached to each end of the blade and resting in grooves in the arms (AMT, Hegner, Sears, and Woodmaster). The one exception to the pivoting blade-lock assembly is the Excalibur II, which utilizes rigid-blade clamps instead.

Pivoting-blade clamps rock in their "cradles" as the blade warps back, giving the blade an even curve that reduces the stress on the fine steel shaft. Two results occur: One, the blades break less often and, two, you can force the saw to cut faster with less blade damage. True, scroll saw blades are quite inexpensive (about 17 cents each, on the average), but the downtime while changing blades and threading back through gets annoying.

Changing the blade on the Excalibur 24

The Delta and Excalibur 24 furnish a locking pin that holds the swinging blade clamp stationary while changing the blades. Without this feature, the clamp twists up against the arm as you torque the locking screw.

Continued

In the machines that have removable blade clamps, you must hold the clamps in a vise or some other holder while you tighten and loosen the lock screw. In Hegner and RBI Eagle models, a simple, timesaving blade-clamp holding device is cast into or screwed onto the table. Hegner also offers an optional four-wing thumb setscrew instead of the hex-cap screw. Although we liked the convenience of not fumbling with a hex wrench, you may find it difficult to apply enough pressure.

Hegner's handy blade-clamp holders

Sears built-in blade clamp holders for precise distancing

Sears goes one step further by building holders for both ends of the blade clamps into the casting. This lets you position the blade with the same distance between the clamps each time. The Sears blade clamps are also designed so you can turn the blade 90° to the arms, but we have reservations about the way it cuts due to the slight rocking motion of the blade.

Here's a tip: If you have a saw with *loose-blade clamps*, purchase an extra pair or two and set up more than one blade. It's a good idea, especially if you want to change blade sizes while cutting a single piece.

PARALLEL ARM SAWS: HOW THEY WORK

Most of the constant-tension saws being marketed today are parallel-arm versions (see the Buymanship Chart on page 56). Two essentially identical arms, one above the table and one below, attach to a bracket with pivot points that are vertically aligned.

The tandem movement of these arms keeps the blade perpendicular to the table as it raises and lowers; it also causes the blade to move forward on the down (cutting) stroke in a slight chopping action, and backward on the upstroke. This translates into faster cutting action—not only because of the chopping, but also because the sawdust can fall out of the cut as the blade moves back. A clean kerf and blade gullets mean cooler running with less blade stress and wood burn. Still, as you turn tight corners and spin the workpiece completely around the blade, the walls of the cut remain almost perfectly at the angle set on the table.

The motor attaches near the front of the lower arm in one of three ways. Hegner and AMT use a short tie rod with the motor just under the right side of the table. This allows for only left table tilt, but it also means a more compact machine.

RBI and Woodmaster use essentially the same system, but with a longer tie rod that allows the motor to be installed far enough from the table to allow for two-way tilt.

The Excalibur 24 uses a variation of those systems. Rather than a tie-rod bolted to the side of the offset cam, you'll find a tie-rod *over* a camshaft, much like a piston tie-rod found in an automobile engine. This makes for smooth and quiet scroll-saw operation.

The Hegner Polymax-3 and the Excalibur II use a belt-drive system that keeps the linkage short and simple, yet allows for some speed change. (See the section of this article on speed control)

Long tie rod with motor mounted below base in Woodmaster (note also the two-way tilt table)

THE C-ARM SAW'S ROCKING ACTION

C-arm design resembles a tuning fork—one piece with a single pivot point either in the center of the C, as in the RBI Eagle, or offset toward the bottom, as in the Delta or the Hegner Hobbymax. The action of the blade in this saw is more of a rocking motion since the two ends of the single curved arm pivot at the same point.

The central pivot point of the Eagle tips the blade slightly forward at the bottom of the downstroke and slightly back at the top of the stroke. This causes a small but visible bowing of the cut if you turn corners too quickly.

The Delta has a pivot point offset toward the bottom of the C-arm at about table level. This way, the upper end of the stroke tilts back further than the central pivot system, but the blade is nearly perpendicular at the bottom of the stroke.

The Hobbymax has an even-lower pivot point; it also has a very short cutting stroke of about ⅜". This tool is designed as a small, high-precision scroll saw for material of less than ¾" thick. With such a short stroke, Hegner eliminated the need for bearings of any kind at the C-arm pivot point and instead used a short spring steel plate. The result: a good deal of rigidity in the arm for a small-scale tool.

Each of the three machines tensions somewhat differently. A short bracket attached to the front end of the upper arm holds the blade clamp and is tightened or loosened by a thumb screw. Delta chose to provide a thumb screw adjustment with a quick-release lever.

The short-stroke Hegner Hobbymax uses a spring steel plate as a pivot point for the C-style arms.

The Delta C-arm saw has an off-center pivot point at table height to keep the blade vertical at the bottom of the stroke.

The RBI Eagle C-arm has a centered pivot point above the table which causes the blade to tip slightly forward at the bottom of the stroke.

OTHER FEATURES TO CONSIDER

Hold-downs

Hegner, RBI Eagle, and Excalibur 24 (which also comes with two alternate hold-downs) use a single footed pad on only one side of the blade. That's fine for larger pieces and it does swing out of the way quickly for blade changes and some types of cutting. But it's not handy for tiny scrollwork. One of the best hold-downs is on the Delta C-arm. It's stout with a little springiness, and it goes down both sides of the blade (which helps a great deal with small pieces).

Dust blowers

Scroll saws produce a lot of fine, powdery dust that will quickly cover your cutting lines if the tool does not have some type of dust blower. Most saws that have a blower run the little air pipe down the hold-down clamp. If you don't use the clamp for some reason, the dust blower is out too. Hegner is the only company that installs their pipe in the upper arm of the saw, which ensures always blowing right on the blade line.

Hegner also uses a very simple bellows mechanism to move that air, as does Delta, Sears and the two Excalibur models. Woodmaster uses an aquarium pump to push the air; however, the design is being modified to accommodate a bellows.

Speed control

All scroll saw models except the Delta and Excalibur 24 use induction motors. The two exceptions have totally enclosed permanent-magnet DC motors, which accommodate variable speed much more efficiently than induction motors.

Hegner and RBI have totally enclosed, fan-cooled induction motors to keep out the fine dust that will eventually damage open motors. An induction motor does not lend itself to electrical speed reduction as easily as a universal motor. However, Hegner does offer it as an option at a premium.

The Hegner Polymax-3, the RBI Eagle, and the Excalibur II are belt-drive tools and allow the operator

Continued on page 74

Print this article

EPOXY

THE "TOUGH-GUY" GLUE MOST WOODWORKERS NEVER USE

While epoxies have long been helping to keep the marine world afloat, their use in the home workshop has been minimal. Maybe epoxy just seems too costly and complicated for most woodworkers. But wait a minute! If you're building a project that requires an adhesive with high strength and weather- and moisture-resistance, or if you're bonding dissimilar materials, epoxy could be the wonder glue you've been dreaming about.

WHAT IS EPOXY, ANYWAY?

Epoxy, a two-part adhesive, consists of an epoxy resin and a hardener that must be mixed before use. In the home shop, epoxies are either the quick-set or the slow-set types. The big difference between the two is working time, or pot life. Seldom can you join an entire furniture project in a few minutes, making a slow-set epoxy the practical choice for larger projects.

● ***Quick set,*** or "five-minute," epoxy requires that you bond the mating pieces within a few minutes after mixing the resin and hardener. It hardens quickly; most of the bonding strength develops in less than 10 minutes. Quick-set epoxy proves perfect for fast home repairs, or when only a small quantity is needed. However, unlike slow-set epoxy, quick-set cannot be submersed in water for long periods of time without weakening.

● ***Slow-set*** epoxy allows you an hour or more of open working time and takes up to 24 hours or more to cure. It's slightly stronger than quick-set, too. Slow-set epoxies often provide the moisture barrier on the exterior of sailboats because of their water-resistance. We used epoxy to laminate the runners in our sled project (see page 44) to ensure that the lamination wouldn't split even in the wet snow.

HOW EPOXY CURES

The epoxy curing process is called—are you ready for this?—exothermic (heat-producing) polymerization. Polymerization, which differs from the loss of water or solvent common to the curing of most other glues, results in only minor shrinkage (0.04 percent). This makes epoxy an excellent gap filler.

Once the chemical reaction begins, polymerization continues nonstop until all possible chemical bonding has occurred. This characteristic accounts for its limited pot life. The resin-hardener mix has a viscosity slightly thicker than varnish and changes to an impermeable solid when completely cured.

The chemical reaction that occurs when you mix epoxy creates an electrostatic bond, almost like that of a magnet, to bond dissimilar materials such as metal to wood. The reaction differs from the mechanical bond of other woodworking glues in which the glue must be absorbed by the materials being joined. It's an important advantage that only epoxy can offer.

An epoxy resin mixed with a hardener produces heat; heating the mixture can speed up the curing process. Conversely, the reaction can be slowed down by cooling the mixture. If you mix an epoxy on a hot day, you'll find that the reaction will take place faster, the pot life will be shorter, and the curing will occur more rapidly. On the other hand a cold shop extends pot life and curing time. If you need large quantities of epoxy, mix several small batches to avoid having the epoxy cure before you have a chance to use it all.

MIXING AND APPLYING EPOXY

Mixing proportions vary for the different types of epoxy formulas. Some mixtures require one-to-one ratios, while others call for up to five parts resin to one part hardener. Read and follow the manufacturer's directions explicitly!

Epoxies come in a wide range of dispensers—from twin hypodermics to larger containers with plastic dispenser pumps (see photo). The two types mentioned dispense a measured amount of resin and hardener. (Note: Pumps may not be fully primed on the first stroke.)

Be sure to wear disposable-vinyl gloves when working with an epoxy. While most people can handle epoxy without being affected, some develop an allergic reaction, especially after continual use. Wear gloves made from a solvent-resistant material, such as rubber, when cleaning with a solvent—*not* the same vinyl gloves worn when applying the epoxy. (The solvent may

penetrate the gloves, making the gloves act as solvent-holding bags on your hands.)

For the cleanest and most effective results, use separate containers for the hardener and the epoxy resin, and a third for the mixing. Use most epoxies in a room above 60° Fahrenheit (although some are formulated to cure in near-freezing temperatures). Mix the epoxy resin and hardener vigorously for several minutes to thoroughly blend the two for complete polymerization.

Epoxy isn't cheap. A gallon can cost from $35–$45, compared to $20 for an equal amount of aliphatic resin (common woodworker's glue). That's why it's essential to mix only what you need. Apply the epoxy evenly to both mating surfaces. If you're doing a small, intricate item, a syringe works well. Unlike most woodworking adhesives, epoxy requires very little clamping pressure as long as you have even and complete contact between the pieces being laminated. In fact, overclamping may squeeze out the epoxy adhesive and can lead to a weak, epoxy-starved joint.

Continued on page 77

EPOXY: 9 TIPS FROM OUR SHOP

1 Mix epoxy in disposable paper or plastic cups. Never use styrofoam—the heated reaction will melt the cup. Larger batches can be mixed in a metal can.

2 Apply epoxy with a brush, spatula, or paint roller to avoid skin contact and to spread an even film on the surfaces being joined. For covering a large surface, pour the well-stirred mixture into a disposable roller pan fitted inside a paint roller tray.

3 When the shop or epoxy is below the recommended temperature range for application, use a heat gun or hair dryer to warm the epoxy and the wood.

4 When joining stock where there's an imperfect fit, use a thickening agent to prevent the epoxy from running out of the joint or gap before it cures. While colodial silica has the best holding power, you can use other powders such as talc, sawdust, or flour.

5 If possible, wipe or scrape away excess epoxy after clamping. Cured epoxy is very hard and can be equally hard on cutting blades.

6 Protect forms and other bondable surfaces with paste wax, polyethylene sheeting, or waxed paper.

7 Applying epoxy to the thread of a screw before insertion will produce up to twice the working load as the same screw without epoxy. It will also prevent the screw from working loose.

8 Mix sawdust of the wood being used (or a slightly lighter-colored wood) with epoxy for a color-matched putty.

9 When using small amounts of epoxy from dispenser pumps (one pump or less), measure the hardener and resin in a graduated container to ensure the correct ratio.

Back: **Epoxy resin and hardener (five-to-one ratio), resin and hardener (one-to-one ratio), solvent, paper toweling, waxed paper.**
Foreground: **Disposable gloves, silica, hand cleaner, syringe and stirring stick, twin hypodermic (one-to-one ratio), disposable brush, disposable roller, plastic mixing dishes and stirring sticks.**

Print this article

People-pleasing Holiday Gifts

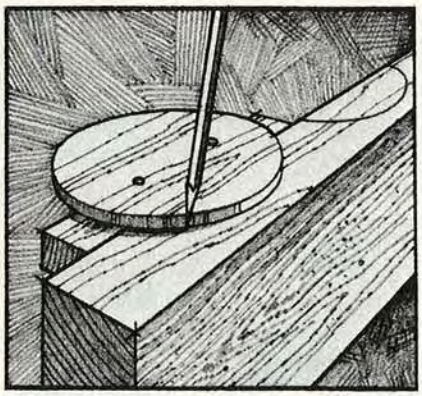
Zebrawood snack tray

For months we've been searching for the best gift project designs available to make your holidays—and those of your loved ones—as merry as can be. We're especially proud of this handsomely styled server. You'll be surprised at how easily—and quickly—this stunning gift goes together.

Note: You'll need some 1½"-thick stock to complete this project. You can either buy stock this size, plane thicker stock, or laminate two ¾" pieces together.

1 Rip and crosscut 1½"-thick stock to 8" wide by 24" long. Then rip a ¾"-wide strip from each edge of the stock to form the tray's center section (A) and the two edge strips (B). Be sure to keep track of which side of the center section each strip is cut—you'll be gluing the pieces together later.

2 Using the Side-Section Drawing as a guide, mark the location of the four pockets, the cutting board recess, and the handle reliefs on one edge of the center section. (To make it easy to accurately mark the pockets, we cut a 3⅞"-diameter template from hardboard, nailed a strip of wood 1" from the perimeter of the circle, and used it as shown



above. We also used the template to mark the handle reliefs.)

3 Band-saw the concave pockets and the handle reliefs to shape as shown in the photo, *right.* (We used a ⅛"-wide blade with 14 teeth per inch. And to keep the workpiece square as it passed through the saw, we clamped an L-shaped support to the stock as shown in the photo. You'll need to move the support several times to keep it on

the table; *be careful not to cut into the clamp.*)

4 Dado the cutting board recess ⅝" deep. (We used a radial-arm saw fitted with a dado blade.) Then bore a 1" hole through the center of the recess (this hole enables you to remove the cutting board easily when it needs cleaning).

5 Clamp the edge strips (B) against the edges of the tray they were originally cut from and trace the handle relief outline onto each end of both pieces. Remove the clamps and cut the relief in the end of each B.

6 Wrap sandpaper around the convex surface of the waste material from one of the pockets and use it as a sanding block to sand the pockets smooth. (If you plan to make several trays, you may want to invest in a 3×3″ sanding drum that you can mount in an electric drill or drill press. See the Buying Guide for details.)

7 Glue and clamp the edge strips (B) to the center section (A), being sure that the handle reliefs align correctly. Using a damp rag, remove excess glue from the pockets immediately after clamping.

8 Rout the top and bottom edges of both edge strips with a ¾″ round-over bit. If you don't have a ¾″ bit, a ½″ bit will do.

9 Mark both corners of each end of the tray as shown in the Top-View Detail, then cut the corners to shape. Sand a gentle downward curve at each end of the tray above the handle reliefs. Sand the entire tray smooth.

10 Cut the maple cutting board (C) to size. Then rout or hand-sand a slight round-over on its top and bottom edges.

11 Finish-sand the entire assembly and seal with a nontoxic oil. Position the cutting board in the recess, add some cheese and crackers, and you're ready to serve!

Project design: Warren Pardi
Photographs: Hopkins Associates, Bob Calmer
Illustrations: Bill Zaun

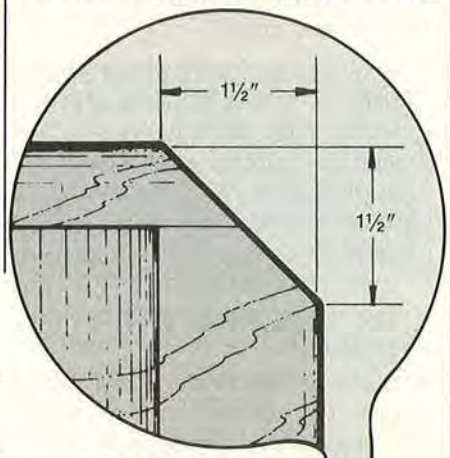
Bill of Materials

Part	Finished Size T	W	L	Material	Qty.
A	1½″	6¼″	24″	zebrawood	1
B	1½″	¾″	24″	zebrawood	2
C	¾″	5 15/16″	6 3/16″	maple	1

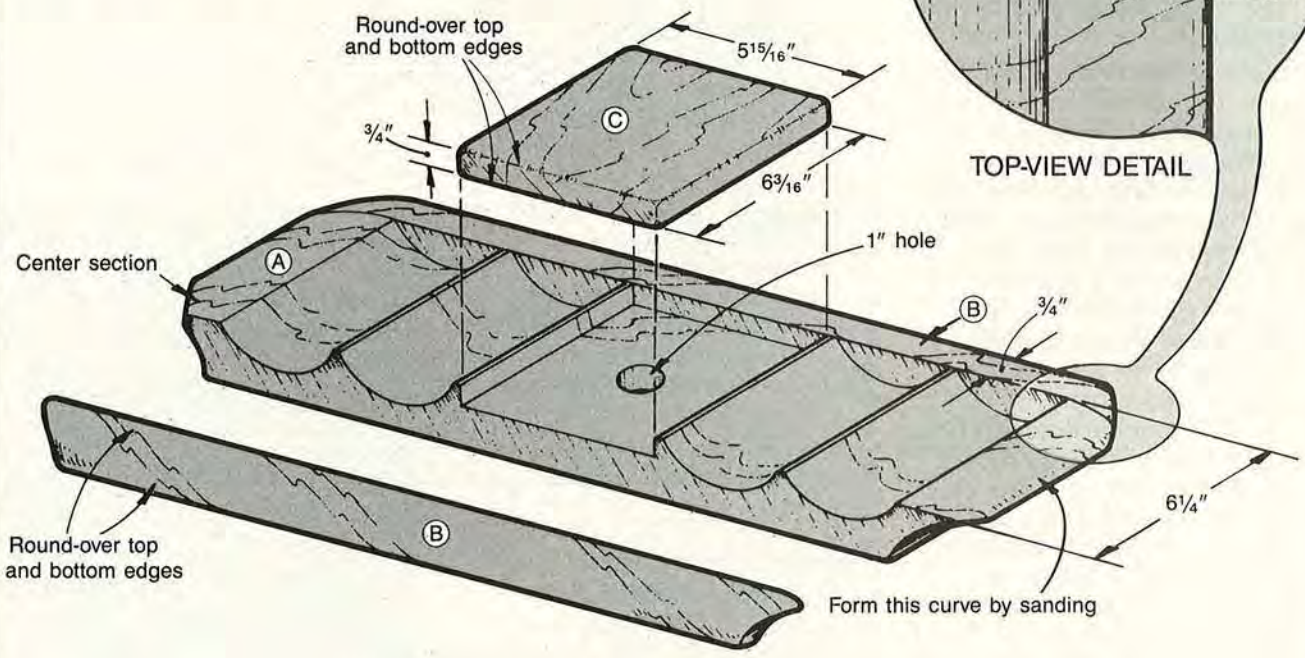
Supplies: nontoxic or mineral oil

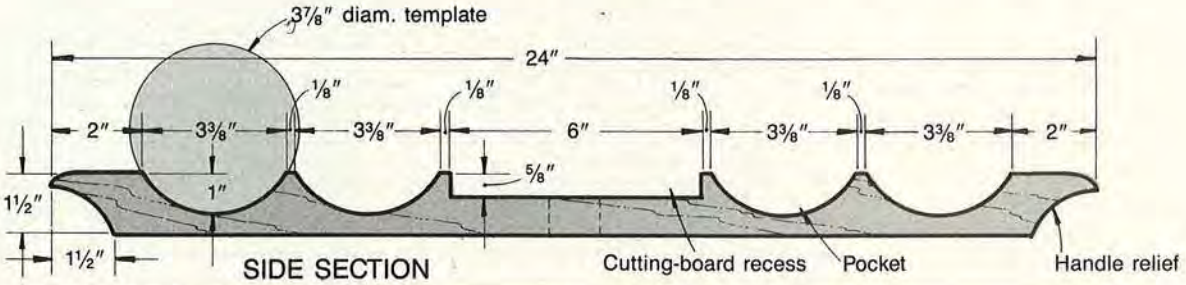
BUYING GUIDE

● ***3×3″ Sanding drum.*** Drill chuck-style drum has an arbor ⅜″ diameter by 2½″ long. Stock #04Q23-ML. $16.75 postpaid. We ordered ours from Woodcraft, 41 Atlantic Ave., P.O. Box 4000, Woburn, MA 01888 (800-225-1153). ■



TOP-VIEW DETAIL





Print this article

Jim-dandy jeep

From the minute it rolls off your "assembly line," this hardwood jeep will provide untold hours of fun for kids as they go four-wheelin' along the back roads of your home. It differs from most toys in that it is built to be easily disassembled. This allows your miniature mechanic to perform routine maintenance or major overhauls with ease and without any mess!

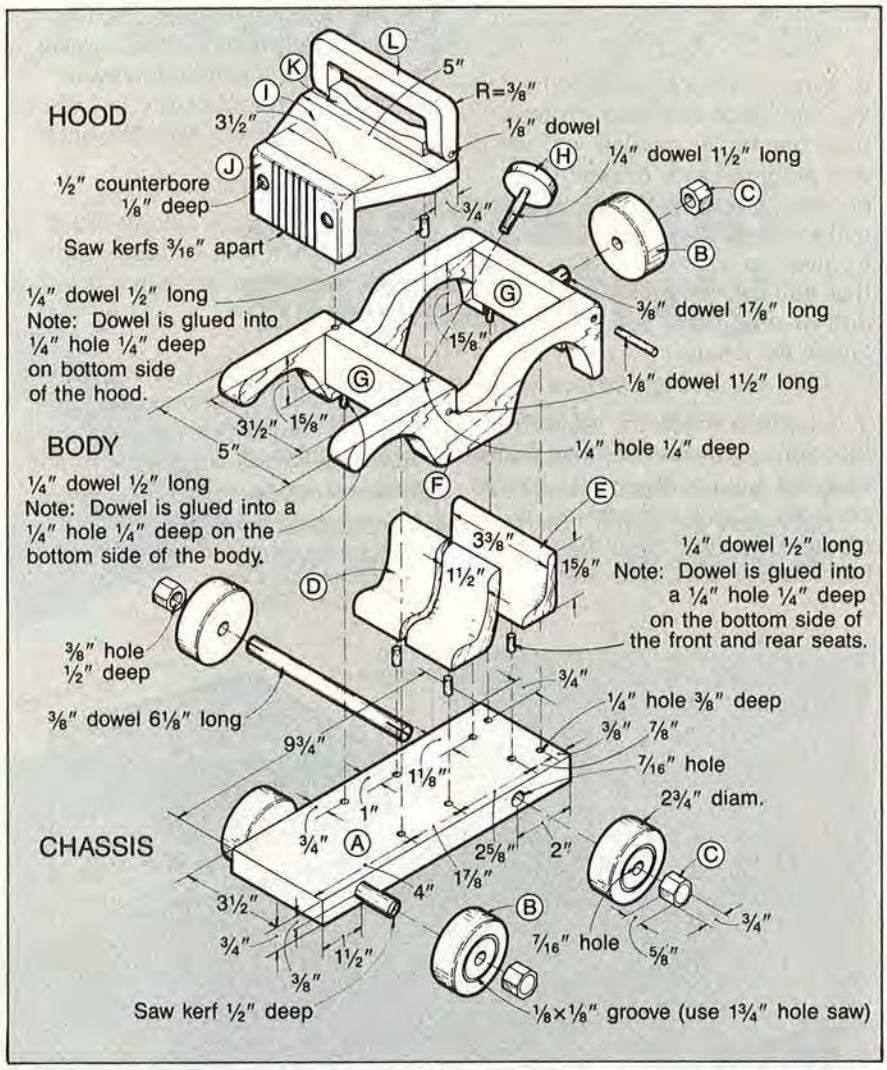
Note: If young children will be playing with this toy, we recommend gluing all small parts, such as the wheel hubs, in place to prevent the parts from being accidentally swallowed.

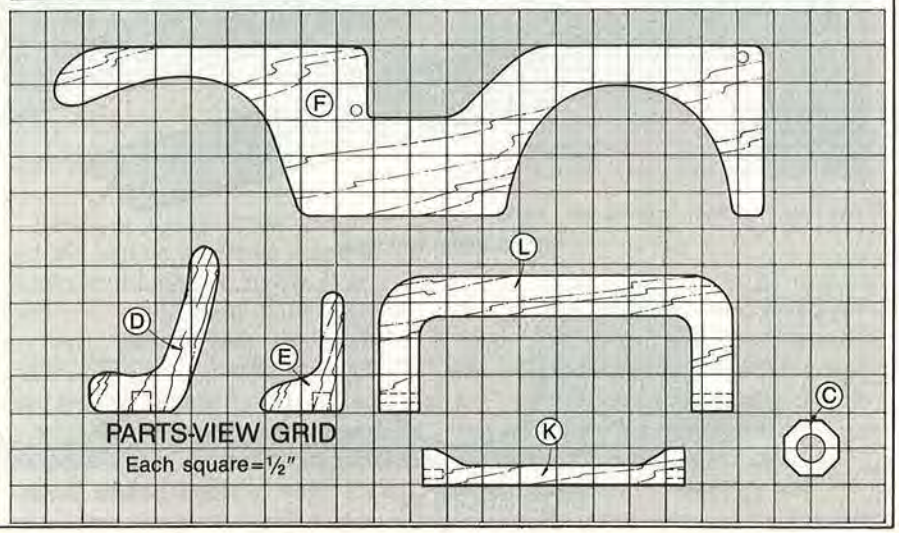
CONSTRUCTING THE CHASSIS

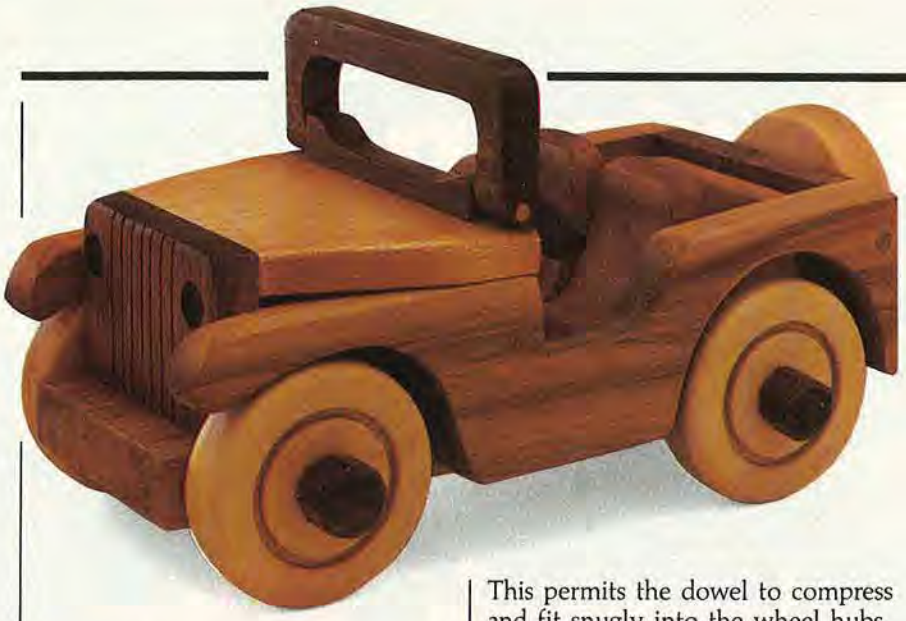
1 Rip and crosscut the chassis (A) to size. Lay out and mark the location of the axle holes as well as those that accept the seats and body (see the Exploded-View Drawing for correct positioning). With the chassis clamped firmly to a work surface or to a drill-press table, carefully drill the 7/16" axle holes centered along the edge. Switch to a 1/4" bit and drill the remaining holes 3/8" deep.

2 Use a 3" (outside diameter) hole saw with a 1/4" pilot bit to cut out the five wheels (B) from clear pine stock. (To ensure accuracy and safety, we recommend that you clamp the stock firmly to a drill press table before making the cuts.) Switch to a 1 3/4" hole saw and cut a 1/8"-deep groove in one face of each of the five wheels.

3 Mount a short length of 1/4" dowel in the drill chuck and place a wheel on the dowel. With the drill running at a slow speed, sand each wheel smooth. Now, redrill the 1/4" hole through the center of each wheel to 7/16" so that it will rotate freely on the 3/8" dowel axle.







4 Rip a 12″ strip of ¾″ walnut to ¾″ wide. Tilt your table-saw blade to 45° and bevel-rip each corner of the strip, using a push stick for safety. With a handsaw, cut the five ⅝″-long wheel hubs (C) from the strip. One at a time, hold each hub firmly in a handscrew and drill a ⅜″ hole, ½″ deep in the center.

5 Cut two 6⅛″ lengths of ⅜″ dowel for the axles. Using a saw with a fine-toothed blade, cut a kerf ½″ deep in each end of each axle.

Bill of Materials

Part	Finished Size* T	W	L	Material	Qty.
A	¾″	3½″	9¾″	butternut	1
B	¾″	2¾″ diam.		pine	5
C*	¾″	¾″	⅝″	walnut	5
D	1½″	1¾″	2¼″	mahogany	2
E	1 1/16″	1⅝″	3⅜″	mahogany	1
F	¾″	2⅜″	9¾″	butternut	2
G	¾″	1⅝″	3½″	butternut	2
H	¼″	1⅜″ diam.		padauk	1
I	½″	5″	3⅛″	maple	1
J	½″	3½″	2⅛″	walnut	1
K	½″	½″	3⅝″	walnut	1
L	½″	1⅞″	4⅞″	walnut	1

*This part is cut larger initially, then trimmed to finished size. Please read the instructions before cutting.

Supplies: ⅛″ dowel, ¼″ dowel, ⅜″ dowel, nontoxic oil finish

This permits the dowel to compress and fit snugly into the wheel hubs.

6 With a band saw, cut the front and rear seats (D and E) as shown in the Parts-View Drawing. Sand the seats smooth.

BUILDING THE BODY

1 Enlarge and transfer the shape of the sides (F) onto a piece of ¾″ stock, then cut the sides, fire wall, and tailgate (G) to size. Find and mark the center of one face of the tailgate and drill a ⅜″ hole ½″ deep for the spare-tire holder. Drill a ¼″ hole ½″ deep at a 45° angle, ⅝″ from the left end and near the top edge of the fire wall for the steering-wheel shaft.

2 Glue and clamp the body parts (F, G) together, removing excess glue once a tough skin has formed. Drill ⅛″ holes 1½″ deep in the jeep sides where indicated in the Exploded-View Drawing. Then, to strengthen the joint, glue the ¼″ dowels into place. Sand the dowels flush with the sides and carefully round off all the outside edges of the assembly.

3 Use ¼″ dowel centers to transfer the location of the ¼″ holes in the chassis of the underside of the body. (Make sure the back of the tailgate and the back of the chassis line up when you do so.) Drill the ¼″ holes ¼″ deep in both G's. Then, glue and insert ¼″ dowels ½″ long in these four holes (this allows the body to be lifted off the chassis).

4 With the body mounted on the chassis, use the ¼″ dowel centers to transfer the location of the holes already drilled in the chassis to the bottom of the seats. Now, drill ¼″ holes ¼″ deep in the bottom of the seats, and glue a ½″ length of ¼″ dowel into each hole.

5 Drill a pair of ¼″ holes ¼″ deep in the top of the body where shown in the Exploded-View Drawing. (These holes will accept the hood assembly.)

6 Glue a ⅜″ dowel 1⅞″ long in the tailgate to hold the spare tire. Using a hole saw, cut the steering wheel (H) to size and glue it to a ¼″ dowel. Both the spare tire and steering wheel assembly are removable from the body.

CONSTRUCTING THE HOOD ASSEMBLY

1 Cut the hood (I), grille (J), and windshield parts (K and L) to shape. (See the Exploded-View Drawing for how to taper the hood. You'll need to enlarge and transfer the shape of parts K and L—see the Parts-View Grid Drawing for help with this.) Cut the saw kerfs and counterbore the headlights in the grill. Sand the parts (I, J, K, L) smooth.

2 Glue and clamp I, J, and K together. Once again using the dowel centers, transfer the location of the holes from the top of the body to the underside of the hood. (Make sure the back of the fire wall and the back of the hood align when doing so.) Drill ¼″ holes ¼″ deep and glue a ½″ length of ¼″ dowel in each.

3 Clamp L in place, flat on the hood assembly, and drill ⅛″ holes through L and ¼″ deep into the ends of K. Sand the bottoms of L in such a way that the windshield rests slightly angled back from center but will drop forward like the real ones. Carefully glue the dowels only into K so that the windshield will rotate freely.

4 Finish-sand the jeep and apply several coats of a nontoxic oil finish.

5 Assemble the jeep, fill 'er up, and take it out for a spin. ■

Project Design: Steve Baldwin
Photographs: Hopkins Associates
Illustrations: Bill Zaun, Kim Downing

Print this article

New horizon desk set

Who wouldn't be tickled to receive this finely crafted desk set from your workshop? The wavy "horizon" design places this gift at the head of its class. One lamination yields enough of the horizon pieces for two complete desk sets.

LAMINATING THE HORIZON DESIGN

1 To make the lamination for the three desk items, start by cutting the maple (A) and walnut (B) to size as dimensioned in the Bill of Materials, plus 1″ in length.

2 Bore a 1″ hole ⅜″ deep in the maple for the sun where indicated on the Lamination-Grid Drawing. Resaw a scrap of padauk to 7/16″ thick and, using a 1″ plug cutter, cut a plug for the sun (C). Glue the padauk plug in the 1″ hole. After the glue dries, sand the plug flush.

3 Sketch a curved horizon line across the maple as laid out in the Lamination-Grid Drawing, being sure to bisect the padauk plug. (We give you the line patterns for our desk set, but don't be afraid to improvise. Any gently curved line will do.)

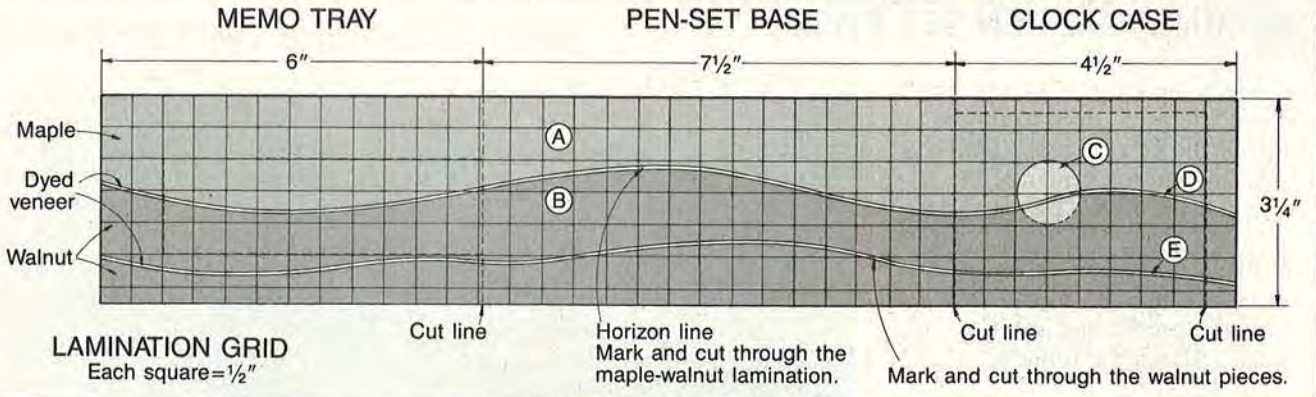
4 Temporarily attach the maple atop the walnut with a few small beads of hot-melt adhesive or double-face tape. Joint the edges and trim the ends of the lamination to ensure that both pieces are perfectly flush.

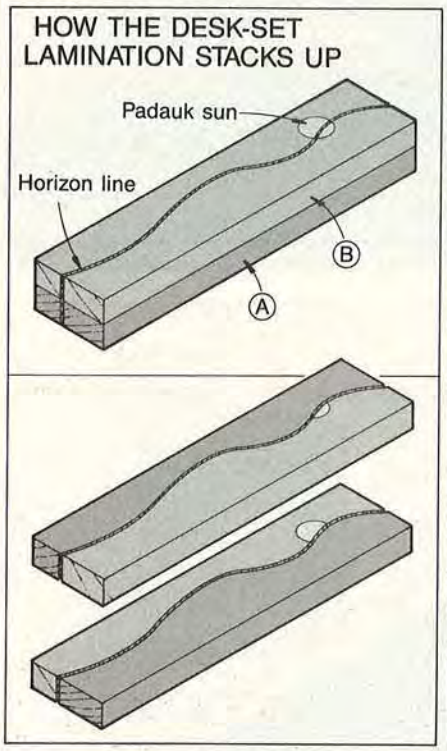
5 Using a band saw with a ⅜″ or ¼″ fine-toothed blade, cut the horizon line through the lamination.

6 Separate the maple from the walnut. (By matching each maple piece with its corresponding walnut piece, you'll end up with two horizon scenes, as shown in the Desk-Set Lamination Drawing.)

Note: The rest of this article explains how to make one complete desk set from one of the horizon lamination scenes.

7 Mark and cut the lower curved line through the walnut (see the





Bill of Materials

Part	Finished Size* T	W	L	Material	Qty.
BASIC LAMINATION					
A*	¾"	3¼"	18"	maple	1
B*	¾"	3¼"	18"	walnut	1
C	7/16"	1" diam.		padauk	1
D*	1/28"	¾"	18¼"	black veneer	1
E*	1/28"	¾"	18¼"	green veneer	1
MEMO TRAY					
F*	⅜"	1½"	5"	walnut	2
G*	⅜"	1½"	6¼"	walnut	2
H	¼"	4½"	6¼"	plywood	1
CLOCK CASE					
I*	¾"	3¼"	6¾"	walnut	2
J*	⅝"	1"	2¾"	walnut	2

*These parts are cut larger initially, then trimmed to finished size. Please read the instructions before cutting.

Supplies: hot-melt adhesive or double-stick tape

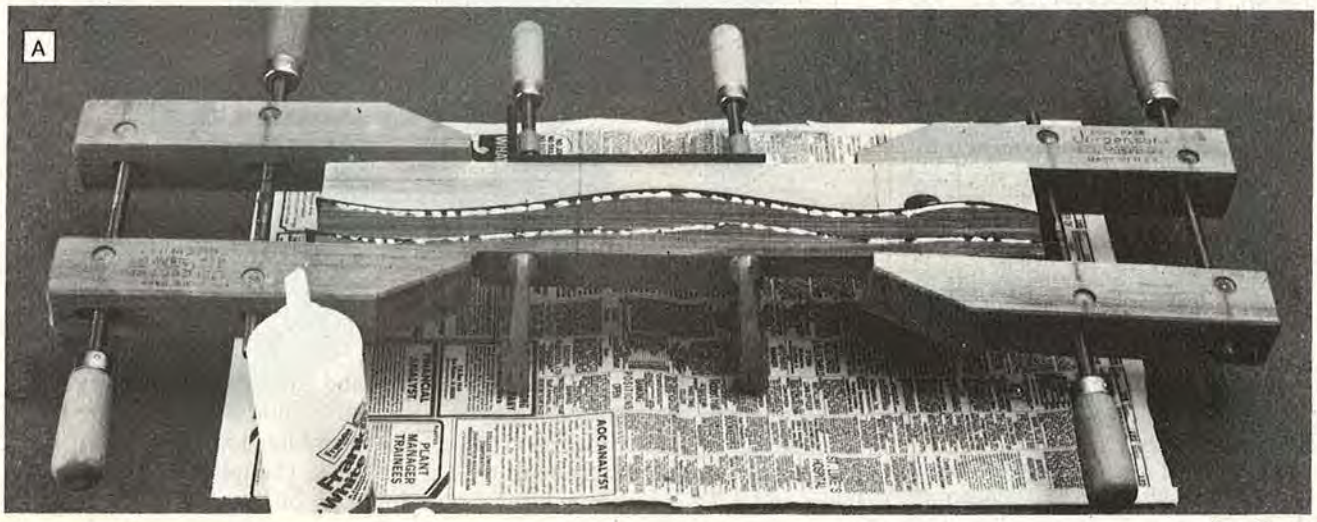
Lamination-Grid Drawing for the line's location).

8 Rip and crosscut two strips of veneer (D, E) as dimensioned in the Bill of Materials. (We used dyed veneers, but you could substitute two thin strips [1/16" or less] of different-colored woods. We cut the veneer with a straight edge and sharp X-acto knife.)

9 Glue parts A, B, D, and E together as shown in photo A *below*, keeping the ends and surfaces of A and B flush.

10 After the glue has thoroughly dried, scrape off the excess glue and protruding veneer. Plane or resaw the lamination to ⅝" thick. Sand all surfaces smooth.

11 Lay out and mark the sections for the memo tray, pen-set base, and clock case as dimensioned in the Lamination-Grid Drawing. Cut the three items to size.

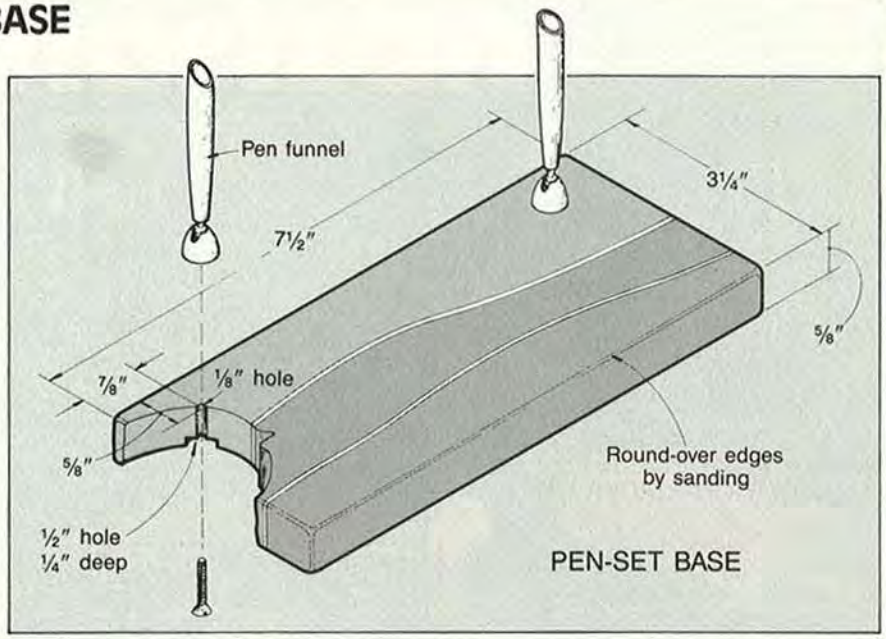


Continued

MAKING THE PEN-SET BASE

1 Mark the location of and bore two ½" holes ¼" deep in the bottom of the pen set base. Drill a ⅛" hole through the center of the ½" hole and test-fit the pen funnels.

2 Remove the funnels and round over the top edges by sanding. Sand the base smooth and apply an oil finish. Attach the funnels.



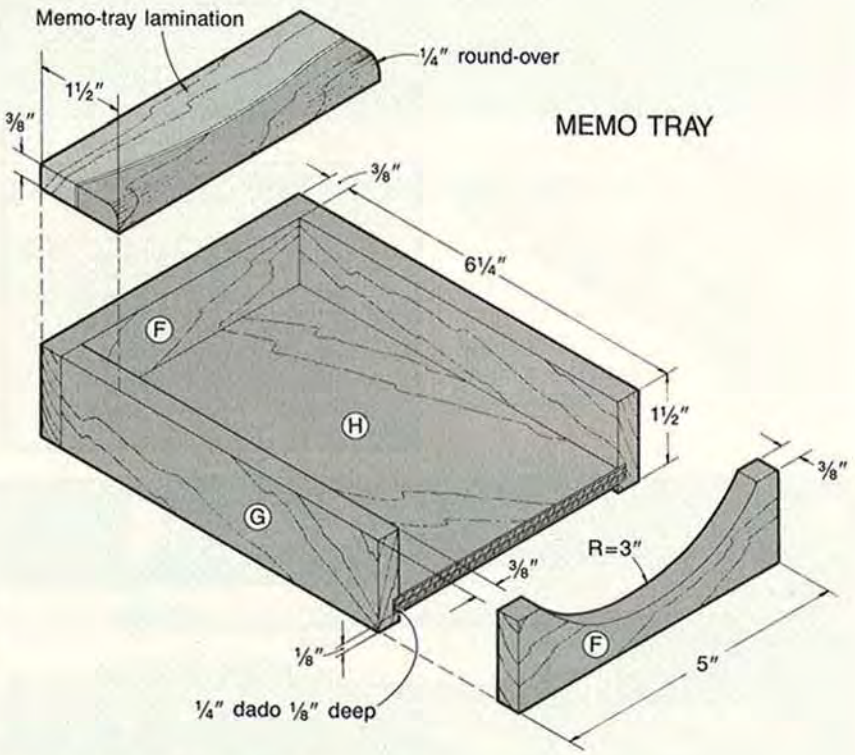
BUILDING THE MEMO TRAY

1 Rip and crosscut a piece of ½"- or ¾"-thick walnut to 1½" wide and 25" long. Resaw or plane the walnut stock to ⅜" thick. (We planed ours to size, removing about 1/32" with each pass. We used a push block when moving the stock over the rotating-jointer blades.)

2 Crosscut a 14" section from the 25"-long piece. Cut a ¼" dado ⅛" deep ⅛" from the bottom edge of the 14" piece. (We cut ours on a router table with a ¼" straight bit.) Crosscut the front and back of the tray (F) from the remaining 11" section, and the two sides (G) from the 14" section.

3 Mark and cut a 3" radius on the front piece. Cut the bottom (H) to size from plywood or thin stock.

4 Glue and clamp the tray together, checking for square.

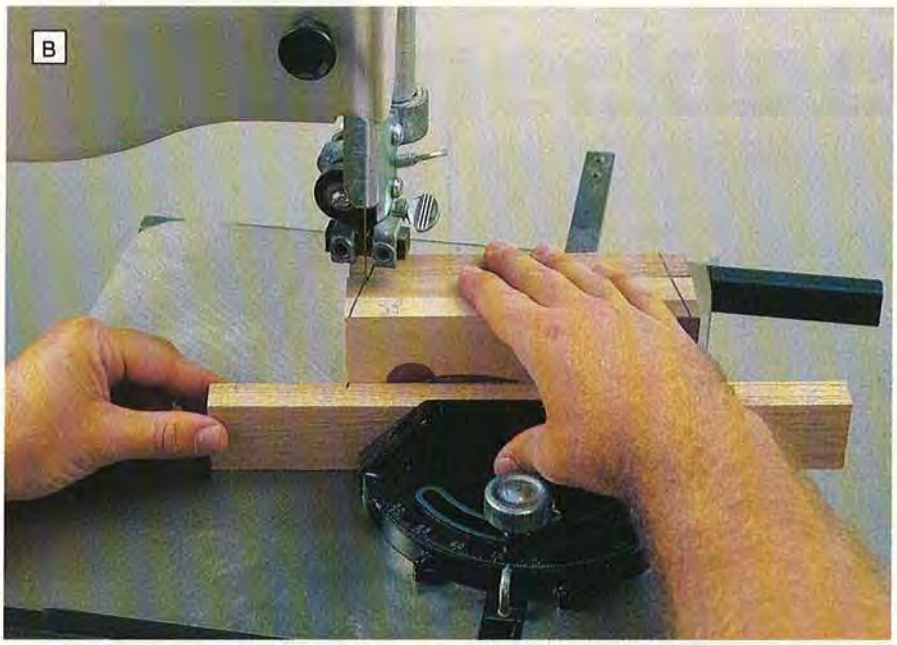


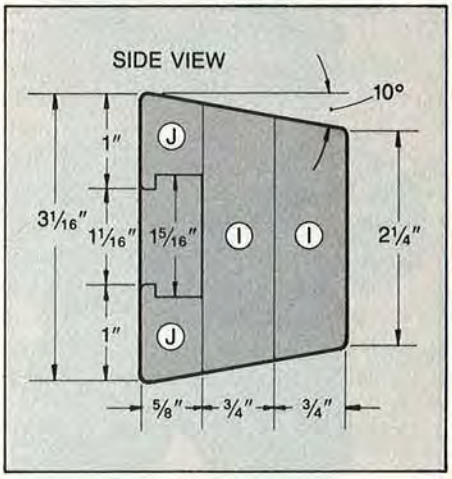
5 Reduce the ⅝" thickness of the memo pad lamination to ⅜" using a band saw or hand plane. (Due to its short length, we clamped the lamination in our workbench end vise and used a hand plane to reduce its thickness. Stock shorter than 8" should *never* be planed on the jointer.)

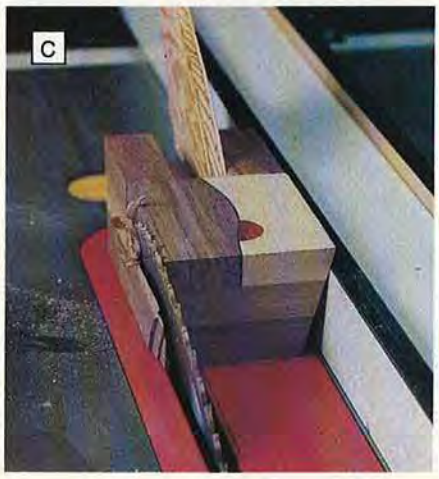
6 Round-over the front edge of the lamination (you can either sand the edge or use a router table with a fence and a ¼" round-over bit).

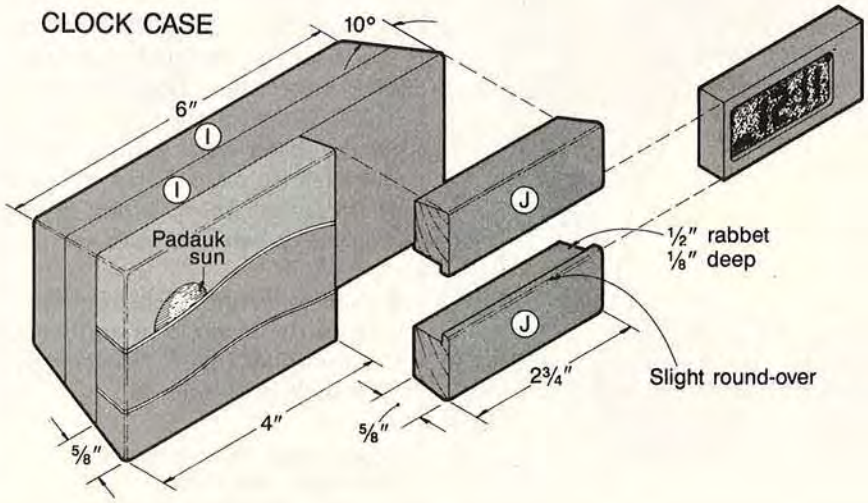
7 Sand the laminate and the tray smooth. Glue and clamp the two subassemblies together. Later, remove the clamps, finish-sand, and apply an oil finish.

CONSTRUCTING THE CLOCK CASE









1 Rip and crosscut the walnut parts (I) to size. Then, rip and crosscut a ¾" piece of walnut 1" wide by 12" long for the clock brackets (J). Resaw or plane this 12" piece to ⅝" thick. Cut a ½" rabbet ⅛" deep the length of the piece. Sand a slight round-over on the outside edge of the rabbet. Cut this rabbeted piece into two 2¾" lengths (J).

2 Glue and clamp the clock's parts together. Be sure to leave enough space for the digital clock. (We cut a scrap spacer the same size as the clock, inset it while clamping and removed it before the glue dried.)

3 Remove the clamps and mark the 10°-angled ends of the clock body. Bevel both ends on the band saw as shown in photo B at *left*.

4 Set the table saw blade at 10° from vertical center. Bevel-rip both edges of the clock body as shown in photo C at *left*.

5 Sand a slight round-over on the edges. Sand the clock body smooth and apply an oil finish.

BUYING GUIDE

● ***Liquid crystal (LCD) clock.*** Stock #16011 (without alarm), $5.95; #16002 (with alarm), $6.50 (battery included). We ordered ours from Klockit, P.O. Box 629, Lake Geneva, WI 53147 (phone toll-free 800-556-2548).

● ***Pen and funnel.*** Gold colored, super deluxe. Stock #42004. Each pen including funnel, $2.55 ($5.10 per pair). Klockit (address above).

● ***Color-dyed veneers.*** Come in eight different colors in widths from 4" to 10" (minimum width of 4" for this project) and 36" long. $1.25 per square foot. Jet Black stock #DV131 and Tropic Green stock #DV123. We ordered ours from Constantine, 2050 Eastchester Rd., Bronx, NY 10461 (800-223-8087). ■

Project design: Russ Peery
Photographs: Bob Calmer
Illustrations: Bill Zaun, Kim Downing

Print this article

The 3 charm bears

Note: Choose clear, select pine for this project. A ¾×10×18″ board will yield the mama bear clothes hanger and the two dresser-top cubs.

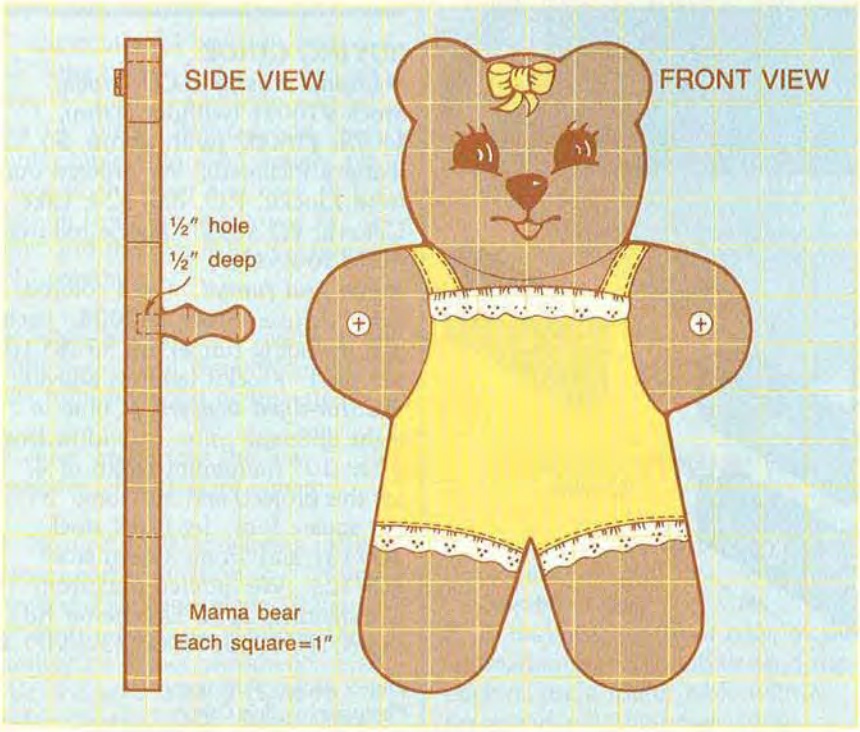
Once upon a time, a woodworker like you decided to make a mama bear and two baby bears in her workshop. Then she found them a home in a very special youngster's room. Her "charm bears" took shape in less than an evening, but the smiles lasted a long, long time. . . .

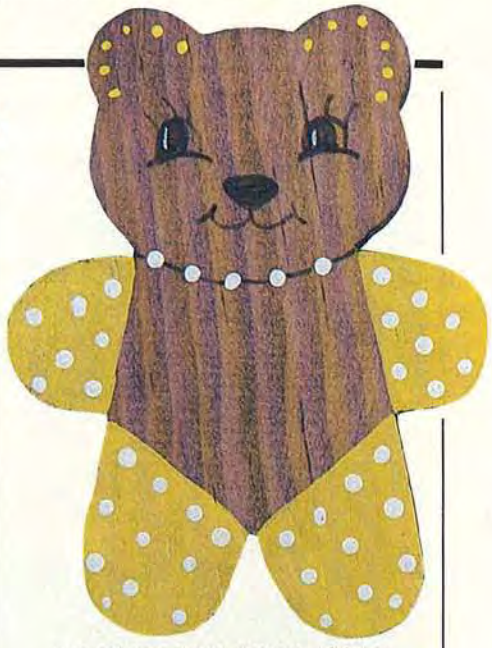
1 Transfer the pattern for the mama bear onto 1″ grid paper, then use carbon paper to transfer the pattern to the pine stock. Next, transfer the full-sized baby bear patterns, *right*, to tracing paper. Again, use carbon paper to transfer the patterns to the pine.

2 Use a scroll, jig-, or band saw to cut the outline of all three bears.

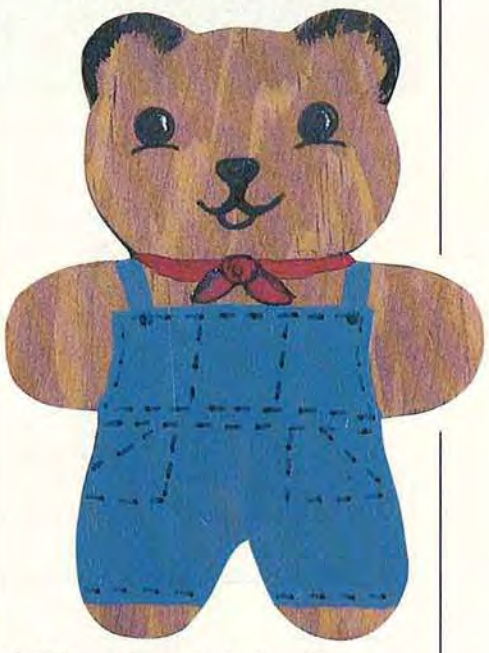
3 Drill ½″ holes ½″ deep into the mama bear's arms for the pegs.

4 Sand the bears smooth, then glue the pegs into the holes. (We used 2½″ Shaker pegs for the clothes hooks.) Stain the three bears.





BABY BEARS (FULL SIZE)



5 When the stain is dry, dress up your bear trio by painting on features and clothes. (We used acrylic artist's colors for the large areas, and did the detail work with a waterproof felt-tip pen.) Spray on a few coats of clear finish, letting dry completely between coats.

6 Nail a picture bracket on the back of the mama bear and hang. Use the other figures decoratively on a shelf or dresser. ■

Project Design: Marilyn Husted
Photographs: Bob Calmer
Illustration: Ron Chamberlain

'Just for her' necklace

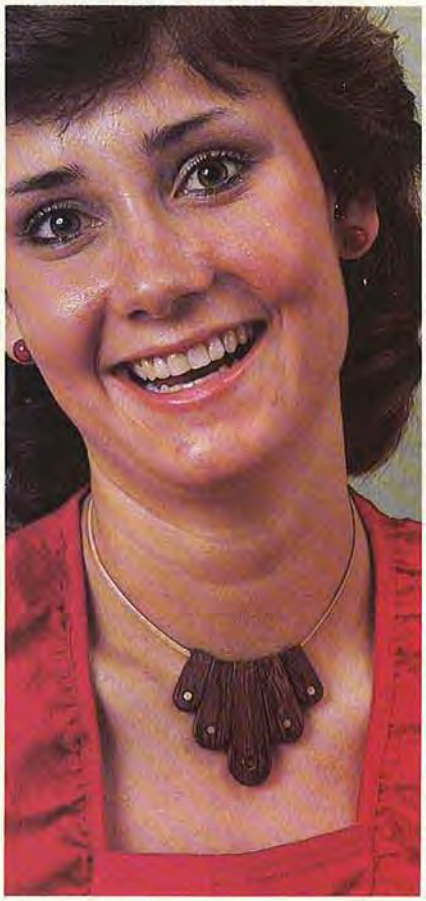
Print this article

Jewelry made of wood? You bet! This hardwood necklace will delight her and showcase your handicraft at the same time. We selected walnut and brass for our necklace, but don't let that limit your imagination. Use copper instead of brass for the inserts, or let the scraps of exotic woods you've been collecting determine the design.

1 Resaw, plane, or sand a 12" piece of scrap stock to 3/16" thick. (We used 1/4" stock and belt-sanded it down to 3/16".)

2 Transfer the shapes shown *below* onto the stock. Locate and mark the holes for the metal inserts where shown in the Front-View Drawing. Then, drill 1/8" holes in the outline of four smaller pieces and a 1/4" hole in the larger center piece. (We found it easier and safer to drill the holes now, rather than after cutting the pieces to shape.)

3 Epoxy and insert 1/4" brass or copper tubing into the hole in the center piece and 1/8" rod into the holes of the other pieces. After the epoxy dries, sand or file the metal flush with the wood.



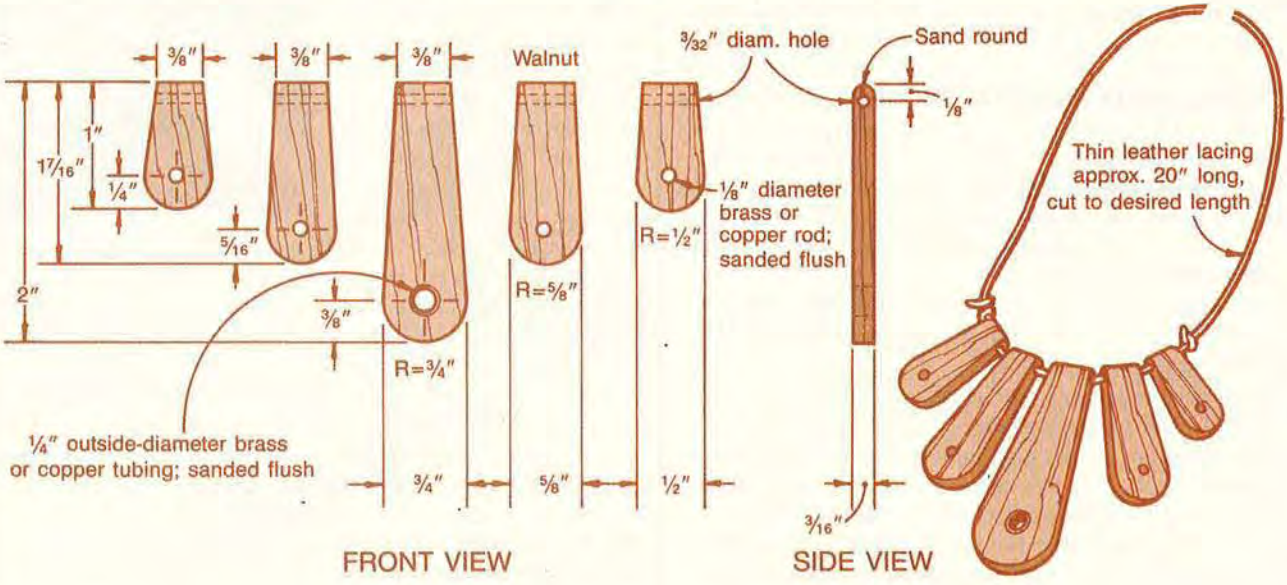
4 Cut the five walnut pieces to shape from the 12" long stock. (We cut ours on a scroll saw; a band saw also works well.)

5 Drill a 3/32" hole 1/8" from the top in the edge of each piece to accept a strand of leather lacing (available at Tandy and some hobby stores).

6 Using progressively finer grits of sandpaper, sand the necklace pieces smooth. Round-over the top of each slightly to prevent it from irritating the neck when worn. Finish with tung oil. (We applied the oil and rubbed it in with our fingers to the desired sheen.)

7 Insert the leather lacing through the holes, cut to the desired length and tie behind the neck (or see a jeweler about obtaining a clasp). ■

Project Design: Dave Ashe
Photograph: Bob Calmer
Illustrations: Ron Chamberlain



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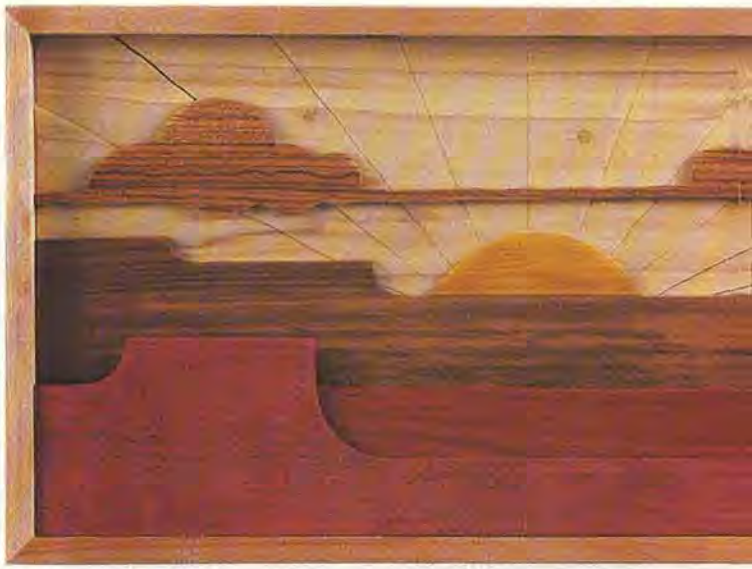
DESERT DAYBREAK
wall hanging



What painting could better capture the spectacular beauty of a desert sunrise than this project design does? Yet the palette here is a collection of thin-sawn woods, and you are the artist. It's a very special gift that someone in your life will treasure for years to come.

Note: You'll need some thin stock for this project. Refer to our Buying Guide following the last step for sources, or resaw your own.

BUILDING THE FRAME

1 Cut the hardboard backing A to size as dimensioned in the Bill of Materials.

2 Rip and crosscut two pieces of ¾"-thick maple to 1" wide × 48" long.

3 Cut a ¼" rabbet ⅜" deep along one edge of each maple strip. Then, from each 48" strip miter-cut two frame pieces (one B, and one C) to length. (As always, test-cut scrap material first to ensure a 45° cut.)

4 Glue and clamp the frame pieces to the backing, checking for square. (We used web clamps to hold the frame together, and spring clamps to hold the backing in the frame.) When dry, remove the clamps and sand the frame smooth.

CUTTING AND ASSEMBLING THE SCENE

1 Transfer the Sunrise-Grid Drawing onto a ½" grid paper. Then use tracing paper to make a second full-sized pattern. (You'll need both patterns in order to cut all of the scene pieces from the stock.)

2 Cut parts D through H to length (32"). Then, sand the best surface of each.

3 Joint one edge of the poplar sky piece (D). Then rip D to size (6"). (The jointed edge of D should sit flush with top frame piece C.)

4 Use a pair of scissors to cut the sky piece from one of the full-sized patterns. Remove D from the frame and use spray-on adhesive to adhere the sky portion of the pattern to it. Cut the rays with a band or scroll saw fitted with a fine-toothed blade. Finish-sand the sky pieces (D), then glue them into position onto the hardboard. (We left a small gap at the cut lines to emphasize the sun's rays and to ensure that all the pieces fit into the frame properly. We used woodworker's glue for adhering the pieces to the backing.)

5 Cut the cloud pattern from the other pattern, and glue it to the zebrawood (E). (We cut the pattern on a band saw as shown in the photo, *below*. Take care to support the long zebrawood piece when cutting; the cloud is fairly fragile.) Finish-sand the zebrawood.

6 Joint the bottom edge of H. Attach the patterns to F, G, and H, and cut them to shape. Cut only the top edge of the pieces; the bottom edge will be overlapped by the next layer of thin stock.

7 Remove the paper pattern from the pieces, then finish-sand.

8 Cut 1"-wide spacer strips from ⅛" scrap material. Glue the first layer of spacers to the hardboard, then glue the teak (F) in place on top of the spacers as shown in the Exploded-View Drawing. The teak overlaps the poplar about ¼", as shown in the Sunrise-Grid drawing. (We ran the first layer of spacers from the bottom of the poplar sky to the top edge of the bottom frame member. We cut the shorter spacers to fit between the bottom of F and the bottom frame member.)

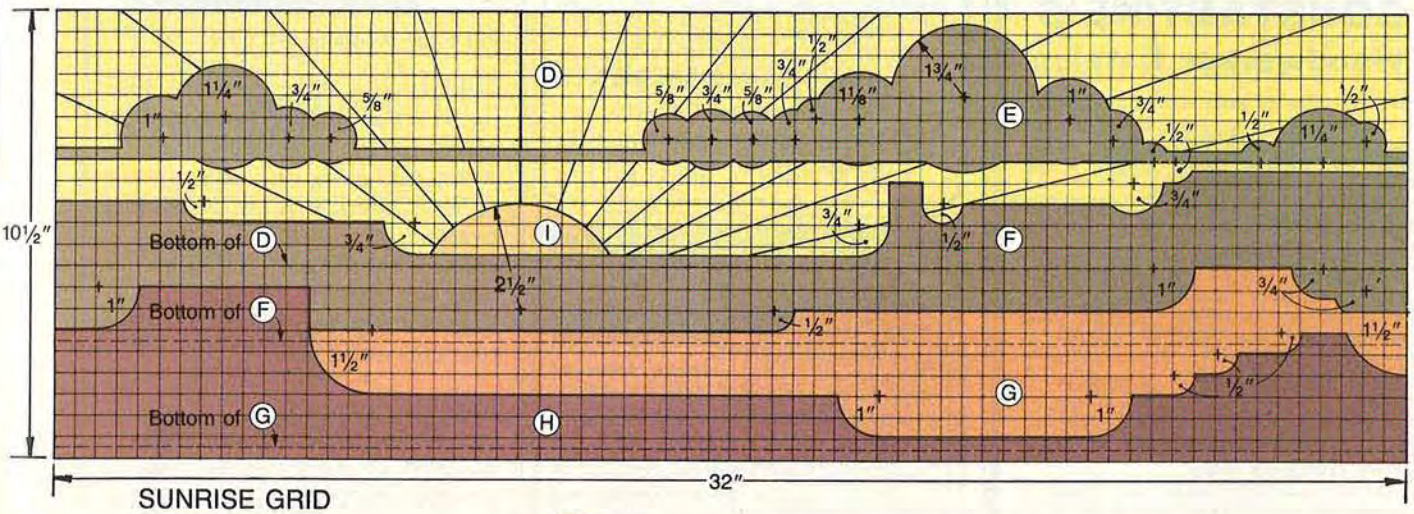
9 Glue the padauk (G) in position so that it overlaps approximately ¼" the bottom of the teak (F). Glue the purpleheart (H) into position overlapping the padauk. The jointed edge of the purpleheart should sit flush against the bottom frame member.

10 Cut the osage orange sun (I) to size and glue it in position on the poplar sky (D). (You may know osage orange as hedge apple in your part of the country.)

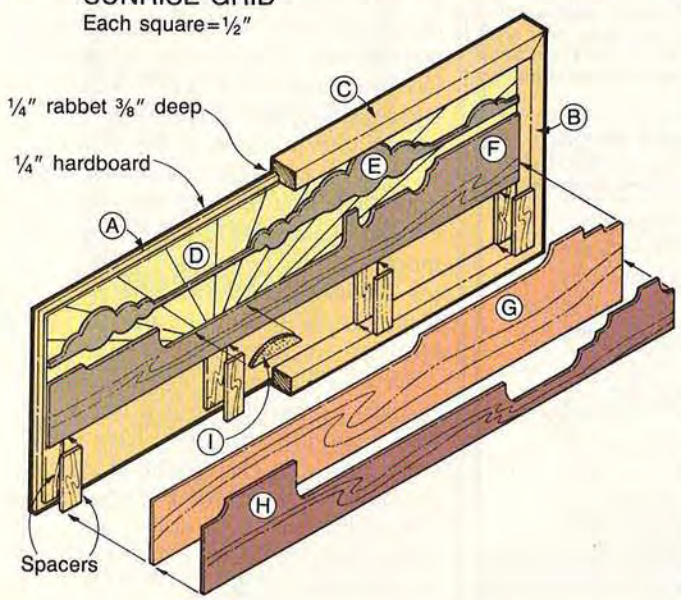
Bill of Materials					
Part	Finished Size*			Material	Qty.
	T	W	L		
A	1/4"	11 1/4"	32 3/4"	hardboard	1
B*	3/4"	1"	12"	maple	2
C*	3/4"	1"	33 1/2"	maple	2
D	1/8"	6"	32"	poplar	1
E	1/8"	3 1/2"	32"	zebrawood	1
F	1/8"	4"	32"	teak	1
G	1/8"	4 1/4"	32"	padauk	1
H	1/8"	4"	32"	purpleheart	1
I	1/8"	1 1/4"	4 1/2"	osage orange	1

*These parts are cut larger initially, then trimmed to finished size. Please read the instructions before cutting.

Supplies: picture bracket, tung oil



SUNRISE GRID
Each square=1/2"



Glue the clouds in position on the sky.

11 Apply several coats of tung oil to all the pieces and to the frame. Attach a picture bracket to allow for hanging your work.

BUYING GUIDE

● ***1/8" stock.*** (When ordering, make sure you advise the supplier of the dimensions of the various pieces you need. Prices are per square foot.) Poplar, stock #W9740, $1.29; zebrawood, stock #W9381, $3.59; teak, stock #W9301, $4.55; padauk (vermilion), stock #W9001, $2.75; purpleheart (amaranth), stock #W9001. We ordered the preceding stock from: Craftsman Wood Service, 1735 W. Cortland Ct., Addison, IL 60101 (312-629-3100). Osage orange, $3 (call about availability before ordering). We ordered ours from: United States Mahogany Corp., 746 Lloyd Rd., Matawan, NJ 07747 (201-583-6300). ■

Project Design: C. L. Gatzke
Photographs: Hopkins Associates, Bob Calmer
Illustrations: Kim Downing

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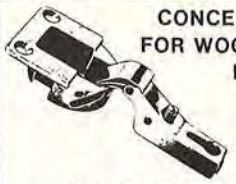

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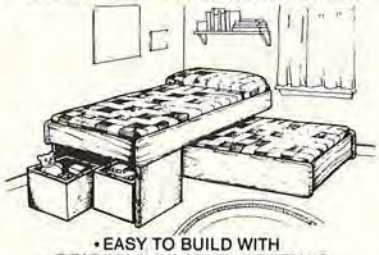

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SCROLL SAWS

Continued from page 59

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Continued from page 61

EPOXY

ADVICE ABOUT CLEANUP: THINK FAST

Due to its quick cure time, epoxy drips and spills demand prompt attention. Protect your work surface with disposable plastic or newspaper, and have plenty of clean, absorbent toweling on hand for spills. Wipe up the contaminated work area or tools with a clean absorbent rag or paper towel.

If caught immediately, some epoxies will clean up with soap and warm water and lots of scrubbing. For any epoxy that remains, dampen clean rags or toweling with a solvent and wipe clean. Acetone, lacquer thinner, and denatured alcohol are good cleaning solvents, although many companies mix their own formulas. For larger spills, use a spatula to pick up the epoxy.

Contrary to popular belief, using a solvent for cleaning epoxy from your skin is actually more dangerous than helpful. The solvent dilutes the epoxy and drives it deeper into your skin; it also dries the natural oils in your skin. That's why your skin appears white and feels so dry after coming in contact with a solvent. We're not telling you to dismiss the use of solvents, we're just telling you to use them safely and only when necessary.

If you do get epoxy on your skin, a waterless hand-cleaner like those used by mechanics does a better and safer job than a solvent. In the workshop, we've sprinkled an ordinary household abrasive-cleaning powder on our hands after being a bit careless when applying an epoxy. Rubbing the epoxy with the cleanser and a little water forms "gum balls" which can be washed off. (It takes only a few scrubbings to realize that prevention is much easier than the cure!) Finish with a thorough washing in warm soapy water. When using a large amount of epoxy or covering a large area, apply a skin barrier cream above the glove line to prevent coming in contact with the epoxy.

STORING EPOXY: USE IT OR LOSE IT

Industrial Formulators of Canada, who formulate more than 100 different basic epoxy resins, advise you to keep the resin and hardener in tightly sealed containers. Otherwise, the hardener reacts with moisture and carbon dioxide in the air, causing it to lose its effectiveness when mixed with an epoxy resin. You also should store the hardener and resin in an area of constant temperature.

Gougeon Brothers of Bay City, Michigan, a leader in the use of epoxies in boat construction, recommends that you purchase only as much epoxy as you can use within 18 months (although Gougeon Brothers report having used properly stored epoxies five years later without significant loss of strength). They also recommend storing it in a dry area where the temperature is kept between 50 degrees and 90 degrees Fahrenheit.

If the hardener looks cloudy and lumpy instead of clear, it's probably contaminated. When stored at excessively cold temperatures, crystals may appear in the resin. To dissolve the crystals, heat water in a large pot to the boiling point, then remove the pot from the heat source. Remove the lid from the resin container (to avoid a pressure buildup), and place the opened container into the hot-water bath, being careful to keep the hot water out of the resin. Stir the warmed mixture until all the crystals have disappeared.

INFORMATION SOURCES

Write these manufacturers for literature and product list of epoxy and related products.

- ***Gougeon Brothers Inc.,*** 706 Martin St., Bay City, MI 48706.
- ***Industrial Formulators of Canada LTD.,*** 3824 William St., Burnaby, B.C., Canada V5C 3H9.
- ***Chem Tech,*** 4669 Lander Rd., Chagrin Falls, OH 44022. ■

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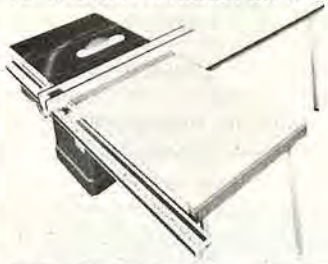

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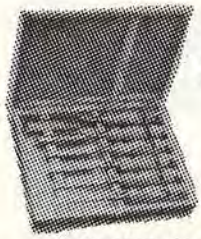

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THE CHRISTMAS WAGON

When the mailman delivered this heartwarming reminiscence from Leon Powell of Memphis, Tennessee, we decided to share it with all our woodworking friends in this holiday issue.

In thinking back I suppose the Christmas wagon was built simply because my father had the skill to do it. He was one of those carpenters who, a generation ago, could perform all the operations needed to build a house. True, there were generally two or three assistants to help with the rough carpentry and to hold boards for nailing. Working totally with hand tools, these all-around craftsmen did whatever task had to be done.

These same skills kept our house in repair as well as various farm implements and tools used to keep a country place going. It was only natural then, during the Great Depression, that such craftsmanship be used to provide some Christmas joy.

"Building a wagon could not be kept secret, so we watched, my two brothers and I, as the project took shape."

Building a wagon could not be kept secret, so we watched, my two brothers and I, as the project took shape. In memory the wagon seems to have been about one-third the size of a standard farm wagon, but it was in a class by itself.

The axles were shaped from seasoned hickory timbers which my father kept on hand for tool handles and such. I can remember him using the handsaw, drawknife, plane, and brace and bit. There was no sanding, yet the wagon parts seemed smooth as glass to youngsters who had yet to handle tools without difficulty. We were awed at the ease with which the wood was shaped, how the oak and gum bed fit together, how the arched top of the front axle served as a fifth wheel beneath the bolster.

Continued on page 80

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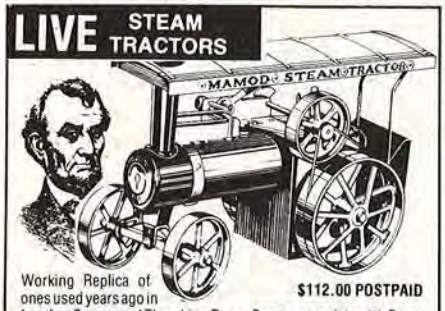

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THE CHRISTMAS WAGON

Continued from page 78

All this work started in late fall when other chores were done. My father, by this time, was out of house-building because few persons in our area had money to build houses. Money from remodeling jobs was supplemented by family farming. So when the harvest was over, the wagon building started. The axles, bed, frame, and other parts of the wagon were completed in a few weeks. Next came the wheels.

Knowing the characteristics of local woods, my father selected a black gum tree for wheel material. This tree, a member of the dogwood family, is difficult to split. We watched my father fell the tree with a one-man crosscut saw. He then cut log sections about 3″ thick from a point where the tree was about 15″ in diameter.

After center-boring the wheels, the holes were enlarged to fit over the axle ends, which had been rounded about 3½″ from a square shoulder. At this point my father took four tin cans saved for the purpose and fitted them over the axles, retaining each with a nail driven into the end of the axle. Axle grease was applied, the wheels fitted, and finally dowels were driven through the axle to hold the wheels on.

By Christmas the wagon was ready. We were delighted, and the wagon was used almost daily for coasting downhill, hauling milk cans, wood, whatever struck our fancy. It was, in fact, the only toy we got for Christmas that year. We used the wagon for a few years, replaced the wheels, and used it some more. When our interest faded, the old wagon was relegated to a barn shed.

In the years that followed, I grew up, went to war, later married, and bought shiny, red wagons for my own children. Yet now, 50 years after the wooden wagon was built for three boys at Christmas, it appears in memory like the masterpiece I truly believe it was. ■

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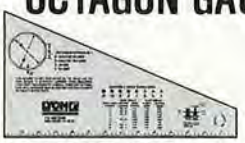

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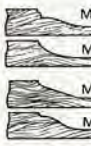

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Circuiting for safety

GUIDELINES FOR SHOP WIRING

Outdated or inadequate wiring makes working in your shop inconvenient, frustrating, and dangerous. Follow these pointers for safety and productivity when you upgrade.

Print this article

Many older, unremodeled homes suffer from too little electrical capacity. Prior to 1960, most homes were equipped with 60-amp service panels. But that was before all the electrical conveniences we enjoy today. If a check of your service panel reveals 60-amp service, don't attempt to run more wires from it to power your shop. You'll simply be compounding a bad situation. What you need is greater capacity—and unless you're qualified to install a larger panel, call a licensed electrician for advice.

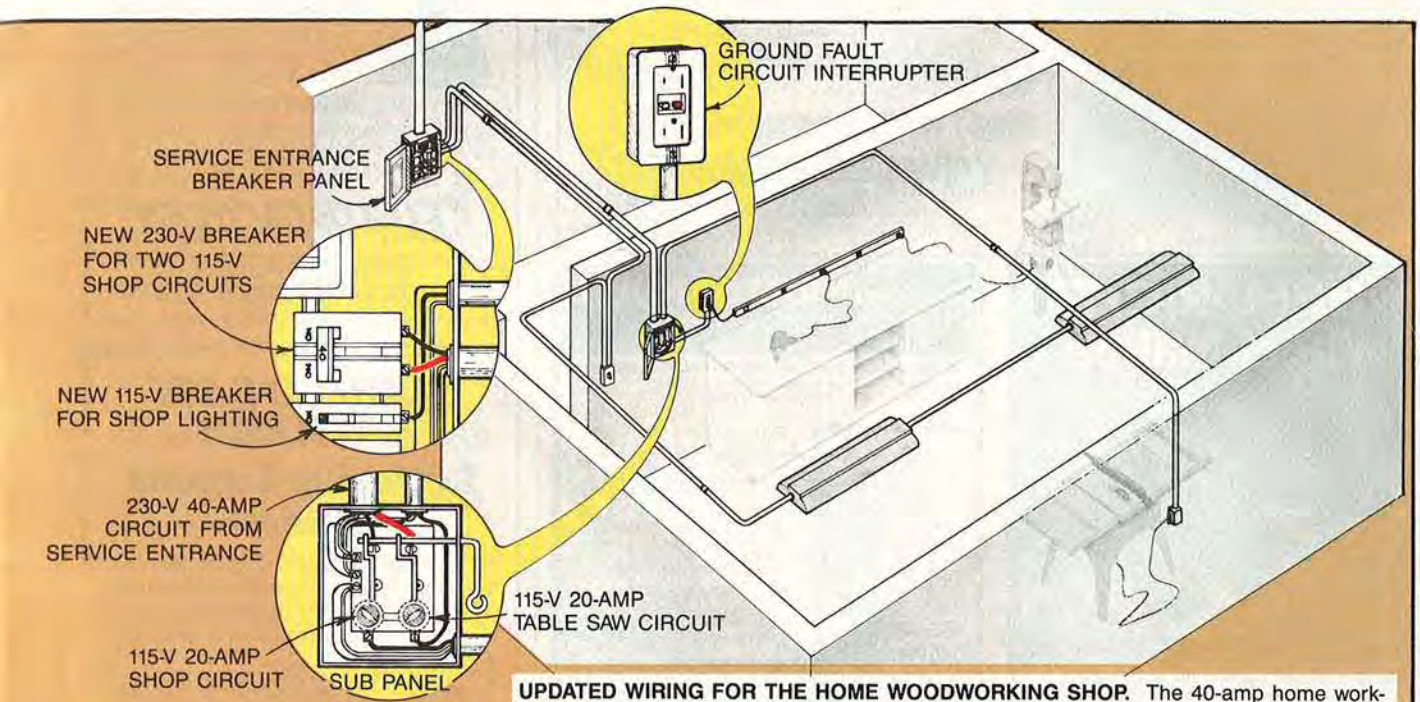
Newer and many remodeled homes have been updated with 100-amp or larger service panels. These homes will normally have a few unused circuits that you can utilize. Even with panels that appear to be already in service, you can sometimes split an existing circuit or two to satisfy minimal electrical requirements.

Sometimes, though, you must add a subpanel in order to supply a larger shop or one that's a good distance from the service panel. And if you have (or plan to have) several large stationary power tools, you should go the subpanel route. If you're unsure, again contact a licensed electrician.

How much lighting do you need?

A circuit combining lights and outlets for power tools risks a blackout when overloaded. Avoid

Continued on page 85



UPDATED WIRING FOR THE HOME WOODWORKING SHOP. The 40-amp home workshop shown features a lockable subpanel, a 20-amp portable power tool circuit with a ground fault circuit interrupter (GFCI), a separate 20-amp saw circuit, and a 15-amp lighting circuit running directly from the main panel. Note that all wires are encased in thin-wall conduit.

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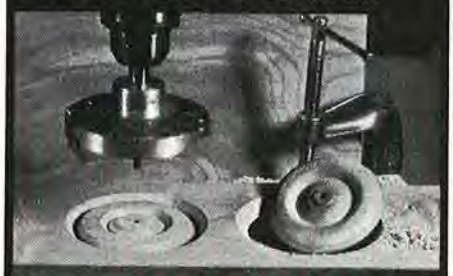

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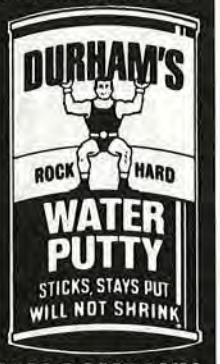

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Circuiting for safety

Continued from page 83

no-light hazards by providing a circuit strictly for illumination. For general shop lighting, this means combinations of 4′ or 8′ 80-watt fluorescent fixtures (use cool-white tubes for brighter light). If you prefer working under incandescent light, use 150-watt fixtures. Task lighting at work stations—such as the drill press, stationary sander, and radial arm saw—requires additional 60-watt bulbs.

A 15-amp circuit will probably do the entire lighting job, but here's how to calculate if you're in doubt: (1) add up all the wattages (bulbs and fluorescents) you have or want; (2) divide that number by the circuit voltage (typically 115 volt in actual performance, rather than 110) to arrive at (3) the number of amps drawn if all fixtures were on. With a 15-amp circuit you wouldn't want to exceed 12 amps, since it's a wise practice to use only 80 percent of a circuit's capacity. This leaves 20 percent for unexpected over-usage which could lead to a blackout if you had figured full capacity.

Assessing your power tool wiring requirements

The number and type of power tools you use (or want to add) determine how many (and what size) circuits you should have. One 20-amp circuit may be all you'll need if you only use small power tools such as routers, drills, circular saws, and jigsaws (these tools normally draw 12 or so amps).

Stationary electric machines, such as a radial arm or table saw, however, have a much higher amperage rating than portable power tools and require one separate 20-amp circuit each. The reason for this singular attention is the increased power draw that stationary tools develop on startup. On a smaller capacity 15-amp circuit, tripped circuit breakers or blown fuses would be normal.

Continued on page 87

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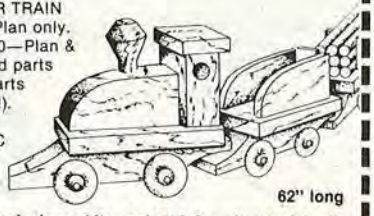

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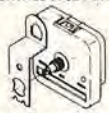

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Circuiting for safety

Continued from page 85

Allocating the circuits as described allows operation at full efficiency, protects motors from heat buildup, and guards your home against overload.

A sure-shot shop wiring solution

If you want to upgrade your shop wiring to handle *any* woodworking situation, we recommend adding a sub-panel with either 40-amp or 60-amp capacity. Though this setup is more costly than running circuits directly from the service panel, it guarantees convenient access and space for needed tool circuits, as well as shorter runs, which reduce voltage drop to your electrical equipment. This type of arrangement offers another great feature—the panel can be shut off and locked to guard against unmonitored use of your power tools.

Note: While it's possible to include all your shop circuits in the subpanel, we think it best to run a 15-amp lighting circuit directly to the main service panel so you won't be inadvertently left in the dark when shutting down the workshop.

Study the model shop wiring illustration on page *83* to see how we ran all the circuits.

Other planning pointers to consider

Beyond shop circuitry, safety hazards lurk in inadequate or outdated wiring, undersized extension cords, and improperly grounded outlets. The following will help you eliminate these dangers:

• *Use only copper wire.* Aluminum wire, your other option, requires special installation procedures. Otherwise it can react with normally used hardware, causing deterioration of the insulated coating and a possible electrical short. Other than price, aluminum wire offers no advantages indoors.

Continued

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• *Protect yourself against electrical leaks and power surges.* In a damp location, such as a basement, a minor leak (or fault) can build to deadly shocking potential, even on a traditionally grounded circuit. This happens primarily with hand-held electric tools. To prevent shock, install a ground-fault circuit interrupter (GFCI) breaker in the subpanel or GFCI receptacles in outlet boxes. GFCI's shut off voltage instantaneously at the first sign of a leak. They also safeguard your power tool motors from the damaging effects of a sudden power surge.

• *Don't crisscross your shop with cords.* Rather than snake extension cords around, install a power bar (strip outlet) with multiple outlets, or try spring-loaded drop cords placed conveniently throughout your shop. If you must use extension cords, be sure they are the three-wire type (one wire is a ground) so they can handle any tool you plug into them.

For further information

We recommend these books available at bookstores and libraries:

● *Practical Electrical Wiring* by H.P. Richter, McGraw-Hill, New York, N.Y. $27.95.

● *Better Homes and Gardens® Step-By-Step Basic Wiring,* Meredith, Des Moines, Ia. $3.95.

● *Basic Wiring,* Time-Life, Alexandria, Va. $11.95. ■

Written with Bill Jones
Illustration: Bill Zaun

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WOOD ANECDOTE

Print this article

CAMPHORWOOD

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Centuries ago, the unsanctioned cutting of a camphor tree in China or Formosa (Taiwan) was punishable by death. That's because camphorwood *(Cinnamomum camphora)*, native to those countries as well as to Japan, was reserved for sacred ceremonial items such as the Chinese *mu-yu* drum used in temples. But *chang-mu*, as the wood is called in China, eventually flourished in foreign trade. Ship captains and other seafarers sought it for their sea chests to ward off moths.

Perhaps it was sawyers cutting camphorwood who discovered that its scent also opened up stuffy noses. Word of camphorwood's reputedly powerful medicinal properties spread to Europe and America, and soon even common folk considered it a cure-all. Indeed, the medicinal compound called camphor, refined from the tree bark, eventually found its way into ointments for the relief of muscle spasms and nasal congestion.

Today, chemical substitutes replace much natural camphor, but stiff competition still erupts between lumber buyers and drug manufacturers when camphorwood comes up for sale. While you won't find camphorwood at lumberyards, it occasionally finds its way to dealers of exotic woods. If you happen upon some, you'd be wise to work it into a silverware chest—camphorwood keeps silver from tarnishing.

The camphor tree, an evergreen, grows slowly. It takes 50 years or more before one becomes large enough to distill camphor from its bark. In that time, the tree can reach 100′ tall, with the spread of its branches frequently double its height. A mature tree also develops many large burls, which, as veneer, becomes marquetry and facing for very expensive paneling. ■

Photograph: Bob Calmer
Illustration: Jim Stevenson

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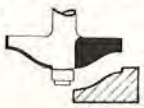

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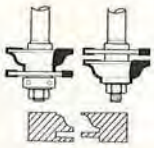

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Harry K. Meech, president of the National Carvers Museum Foundation, a non-profit corporation that directs activities and handles day-to-day business for NCM, says that members actively support their museum and the association because "it's a labor of love." In turn, Meech sees to it that NCM "does whatever it can to help carvers."

Headquarters for NCM is Monument, Colorado, just a stone's throw from the U.S. Air Force Academy. Gigantic Monument Rock provides the backdrop for a museum built in 1972 with funds raised by members. Its 10,000 square feet of exhibit space displays the work of 6,000 carvers from all over the world. In July of this year, NCM dedicated an educational wing, again built through members' help. Future plans call for a gallery to show work of top professional carvers. (The museum, open daily year-round, is located west of I-25 at Exit 158.)

Through NCM, members have access to carving tools and supplies, mail-order courses, and woodcarving seminars and classes held at the museum in Monument. Besides various carving how-to books published by NCM—available to members at reduced cost—membership includes a subscription to *The Mallet*, a monthly 64-page magazine of news, tips, and instruction. Annual memberships begin at $10 and feature a carving course, materials, and tools (various advanced memberships with more benefits are proportionately higher). Life and sustaining memberships are also offered. For more information, write: *National Carvers Museum, Dept. W, 14960 Woodcarver Road, Monument, CO 80132.* ■

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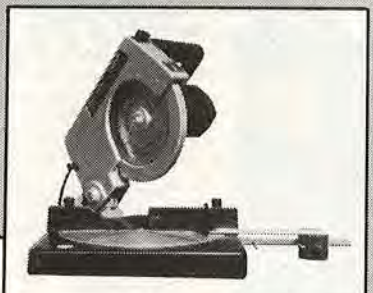

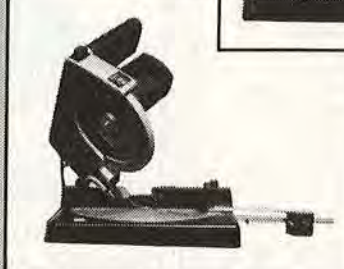

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Japanese Woodworking Tools: Their Tradition, Spirit, and Use

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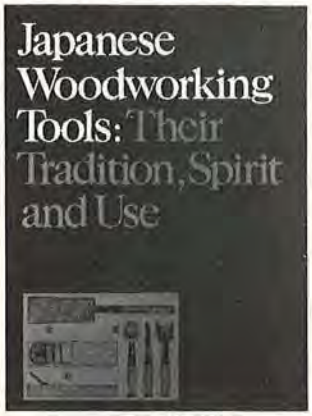

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Each category of woodworking tools described begins with a tale that reads as intriguingly as passages by Pearl Buck in her books about China. Ōdate sets the stage, humanizes the scene, and introduces the tools almost as characters. Regarding *nokogiri* (saws), he explains that they are designed to cut on the pull stroke because the Japanese tradition is to sit or squat on the floor while working: ". . . it must have seemed easier to adapt the saw to a pull stroke [when it was introduced from China] than to change their traditional working postures." For these insights alone, his book rates as a must read.

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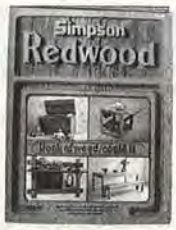

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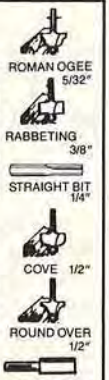

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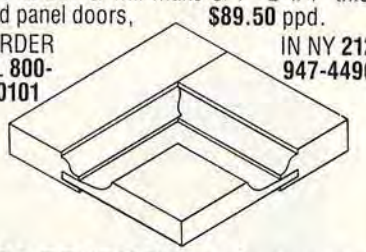

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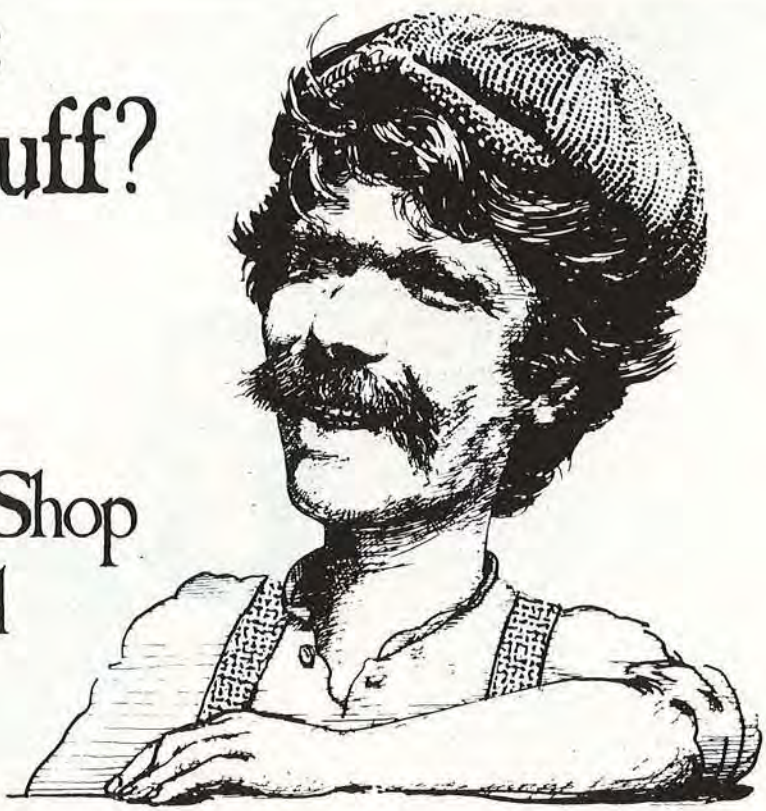

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Print this article

The Bulletin Board

FACTS, FACES & FABLES OF INTEREST TO HOME WOODWORKERS

WHY GOOD WOOD COSTS SO MUCH

You could really save money if you bought hardwood directly from the logger—black cherry at $350 a thousand board feet, hard maple for $305 a thousand, or the same amount of red oak for $500! That's what Wisconsin mills paid, on the average, for prime sawlogs early this year, says a state forest industry report. At your lumberyard you'd pay eight to ten times those board foot prices.

Why the big cost difference? Most wood you purchase at retail happens to be kiln-dried and stable, ready to work. Getting wood to that stage costs a lot of money. Rough-sawing the logs, air-drying then kiln-drying them, plus the loss of 25 percent to checks and splits, doubles their initial price. Interest charges for the year of seasoning, storage, handling, and shipping doubles the amount again. Now add the charges for broker's fee, surfacing two sides, and the 50 percent markup the retailer has to have to cover overhead and profit, and you can see why there's such a big spread between wood prices off the stump and at the lumberyard.

WHAT WAS A DOG TO DO?

Prior to the 1900's, dogs had little attraction to fireplugs, since the plugs, then made of wood, were at the bottom of a hole in the ground.

Back then, notes the American Water Works Association, wooden waterlines were buried in the ground, just as cast iron lines are today. But instead of above-ground hydrants, holes were dug down to the lines, which were drilled and fitted with wooden plugs. In case of fire, the plug was pulled and water filled the excavation. Firemen pumped the water from the hole; the fire out, the plug was replaced.

What kinds of wood could hold water underground? According to the Association, coopers staved up redwood for this purpose on the West Coast where it was plentiful. In other parts of the country, 8" to 10"-diameter hickory, elm, or other hardwood trees were bored for a 1½" hole, then buried. They leaked a little, but worked.

AROUND THE NATION

Excellence in Woodworking. Nov. 2. Ramada Inn, Columbia, Mo. Exhibit and sale of woodworking projects; displays of equipment and supplies. Sponsored by the Midwest Woodworkers Association.

Fair of Traditional Crafts. Nov. 2–3. Old Sturbridge Village, Sturbridge, Mass. Exhibit and sale of pottery, metal, wood, and textile items.

Midwestern Wood Carvers Show. Nov. 2–3. Belle-Clair Exposition Hall, Belleville, Ill. 15th annual show. Exhibits, displays, demonstration of tools. Sponsored by the Midwestern Wood Carvers Club.

Woodcarvers Festival. Nov. 2–3. Mountain Side Recreation Center, Wallingford, Conn. First annual New England Woodcarvers Competition.

Northwest Woodcarving Show/Sale. Nov. 9–10. Western Washington Fairgrounds Expo Hall, Puyallup, Wash. 5th annual.

Woodworking World Shows. Nov. 15–17. Charlotte Civic Center, Charlotte, N.C. **Dec. 6–8.** Oakland Convention Center, Oakland, Cal. Tools, supplies, demonstrations, and seminars for woodworkers.

North American Songbird Carving Championship. Nov. 15–17. York Fair Grounds, York, Pa. Cash awards. Sponsored by York Chapter Ducks Unlimited.

Artistry in Wood. Nov. 30–Dec. 1. Marymount College, Arlington, Va. 11th annual woodcarving show sponsored by the Northern Virginia Carvers.

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Walnut burl, used on the dashboards of Jaguar cars, actually comes from California. The classy dash, made in the firm's woodworking shop, takes six hours of handcrafting to produce, far less than its travel time.

WAS THERE REALLY A MR. BLACK AND A MR. DECKER?

Yes, woodworkers, there was. The giant, international producer of power tools we know as Black & Decker was founded in 1910 by S. Duncan Black, age 27, and Alonzo G. Decker, 26. With $1,200 they saved and raised by selling stock, this inventive pair of machinists began the Black & Decker Manufacturing Company in Baltimore.

The company built machines to cap milk bottles, address letters, dip candy, pick cotton, and add numbers. In 1912, Mr. Black and Mr. Decker adopted the now-familiar hex trademark. A year later they were able to pay a cash dividend.

By 1917 the young pair had received a U.S. patent for their portable electric drill with a pistol grip and a trigger switch. This ½" drill, and a small electric air compressor, were the first products to carry the Black & Decker label. Success came immediately, and by 1919 the now-thriving company had built a new plant and passed the $1 million sales level.

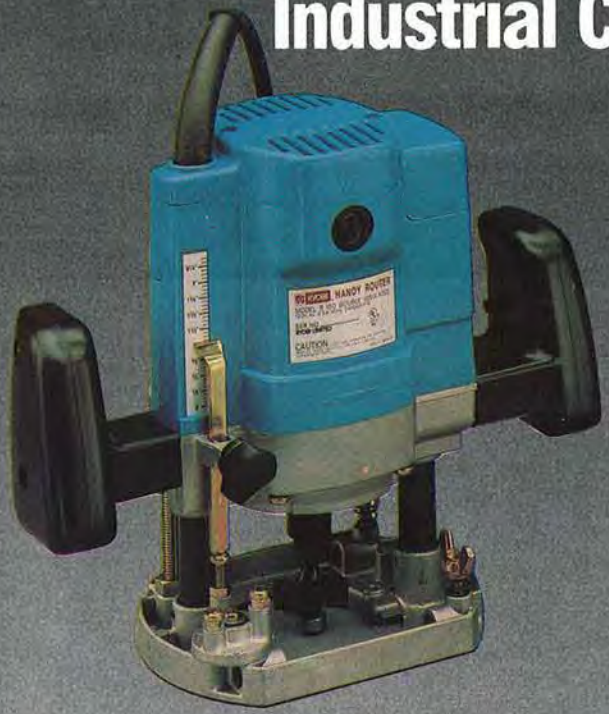
S. Duncan Black

Alonzo G. Decker

Celebrating its 75th birthday this year, Black and Decker has operations around the world, and an expanding new housewares line. A son of one of the founders, Alonzo G. Decker, Jr., represents the original founders as the firm's Honorary Chairman. ■

Get a FREE Ryobi Router

and save $213.00 when you buy Freud's NEW Industrial Carbide Router Bit Set.



15 carbide bits and box jointed wooden case. (Purchased separately would cost you over $300.00)

Router Reg. $162.00, Router Bit Set $300.00 Value, Total Value $462.00

Yours for only $249.00

The Router Bit Set

Freud engineers have designed an industrial quality carbide router bit set at an affordable price. These precision tools are of the finest quality, and manufactured using only carbide or carbide-tipped bits. Carbide will last up to 50 times longer than steel bits before sharpening is required.

These bits exceed all requirements when cutting hard or soft woods, plastics or composition materials. In manufacturing, specific carbide grades are used to insure durable edges, and all bits are ground twice. This provides an extremely sharp mirror edge that cuts like no other on the market.

90-100 Set consists of:

Item	Description	Cutting Length	Cutting Dia.	Radius (Bevel)	Depth of Cut	List Price
04-106	Solid Carbide Straight 2 Flute	3/4	1/4			11.05
04-140	Straight 2 Flute	3/4	3/4			15.60
16-100	Mortising	3/4	1/2			12.73
18-104	Solid Carbide Round Nose	1/2	1/4	1/8		17.64
20-104	"V" Grooving		1/2		1/2	21.15
22-104	Dovetail		1/2	(14°)	1/2	16.33
26-100	Panel Pilot	3/4	1/4			9.43
30-106	Cove			1/2	3/8	33.64
32-100	Rabbet	1/2			3/8	27.62
34-114	Rounding Over	With Bearing Guide		3/8		30.03
38-100	Roman Ogee	With Bearing Guide		5/32		32.90
40-106	Chamfer	1		(45°)		26.42
42-106	Flush Trim	1/2	1/2			15.62
64-100	Solid Carbide Flush Trim	3/8				7.64
66-100	Solid Carbide Bevel Trim	1/4		(7°)		8.30

Box jointed wooden case, value $28.00

The Router

Ryobi (Model R-151) 1 Horsepower Plunge Router with new trigger switch on handle. Plunges 0 to 2 inches. It's light weight and compactness makes routing easy to handle. The plunge depth is set quickly by thumb action. The stop block can be adjusted for 3 different cutting levels. 24,000 RPM's. Double insulated. 1/4" collet capacity. Comes complete with router bit adapter, template guide, straight guide and spanners.

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